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ESSAYS

ON THE NATURAL HISTORY AND ORIGIN OF PEAT,

BY ROBERT RENNIE, M. D. *of Kilsyth in Scotland—Abridged for the Massachusetts Agricultural Journal, by the President of the Society.*

[The subjoined article, which treats of Peat and the several varieties of Mineral Coal, is of greater length than can be acceptable, we fear, to many readers, in a work of this kind. But on the other hand, every one will be ready to acknowledge that he has occasionally experienced no inconsiderable disappointment and vexation from the common practice adopted in periodical works, of publishing a part only at a time, of an elaborate but interesting essay, or some narrative, and being obliged to defer the gratification of curiosity or the thirst for knowledge, until the appearance of another Number. As respects the following Abstract, we think the importance of the subject entitles it to the space which has been given to it. We ought not to forget how much the sufferings occasioned by the scarcity of fuel, during the late war, might have been alleviated by a more general use of Peat, to which many more people would have had recourse, could the knowledge relative to this species of fuel contained in this treatise have been earlier diffused through the country.

It gives the necessary information for a just estimate of the value of our peat bogs—the proper instruction as to the several varieties of peat—their comparative richness, as fuel, and the distinguishing marks of each. A close affinity is traced between these and the mineral coal; and the vegetable origin of both is satisfactorily proved.

We are sensible that this essay is more scientific, than we could wish, considering that the objects of the Society are to give information to cultivators generally. But the subject being one of great in-

terest to the public at large, we have thought it our duty to present it to our readers. If we had possessed in this part of our country a Journal devoted to chemistry or physical science, perhaps it would have found in such a Journal a more appropriate place. As this is not the case we present it entire in the Agricultural Journal. We hope to be able by the assistance of Agricultural Societies throughout the State to make our publications interesting to all descriptions of cultivators.]—PUBLISHING COMMITTEE.

Introduction.

THE following extracts are from a number of Essays, dedicated to the President and Members of the Board of Agriculture, established by the Government of Great Britain, on the important subject of reclaiming Peat lands for agricultural purposes, or preserving them and increasing their growth for fuel, as a substitute for wood and earth coal, by the Rev. Dr. R. Rennie of Kilsyth in Scotland. He considers the natural history of Peat, or what is generally denominated Moss on the continent of Europe, as a substance that has been generally neglected, previous to his undertaking it. He has published two volumes on this subject and promises a third. The work contains many repetitions and similar opinions of a number of philosophic gentlemen in different parts of Europe, especially the celebrated De Luc of Geneva. This work describes every variety of coal, as having been formed from the same materials as peat, and shews the alliance so clearly, as to draw a fair conclusion that the coals are only a more complete bituminization of Peat, and are easily traced to a vegetable origin. He makes five distinct varieties of coal: the first, he calls Bovey coal, which contains some vegetable matter, not completely bituminated, and seems to be the first grade from peat; the second variety, he calls Surturbrandt coal, which is distinguished from other coal by its containing the perfect form of the ligneous vegetable, and often one part of a tree is completely formed into coal while the other part remains wood; the third variety is called Pit coal, in which many parts of the vegetable may be traced, but is entirely bituminized, which is the case with Jet, though he considers this variety as the most perfect; the fifth, he calls Blind coal, which appears to be almost pure carbon, without any bituminous matter mixed with it.—Hence it is not inflammable but by the aid of some inflammable

substance and a strong current of air, the oxygen of which parts with its heat which becomes intense and joins the carbon, and flies off in carbonic acid gas—it consumes very slow, from the compact nature of the coal. All these inflammable substances are formed from vegetables submersed in stagnant water, in a temperature so slow as not to admit of fermentation, but only a solution and union of the hydrogen or inflammable part of the vegetable and its carbon, which appears to be the origin of all bitumens. Most peat ground may be converted into the richest soils, by completely draining the water and exposing the surface to the air and sun, when it is not wanted for fuel. A chemical decomposition takes place by a warm temperature and the gases pass off into the air, and the best vegetable mould is formed. In the northern parts of this country peat is undoubtedly formed in abundance, prepared by nature for fuel. Perhaps under the masses of peat, in our boggy lands, that produce nothing useful for animal food, may be found coal of the best kind, though no doubt deeply immersed in water; and in the present state of the country, it may be found too expensive to bring it into use. Peat completely formed for fuel becomes every day more important as wood decreases. Our shaking meadow lands, that produce coarse grass hardly fit for use, on examination are composed of a deep half liquid matter, which will be found to contain the best materials for fuel. In many places through which the Middlesex Canal passes these bogs are from twenty to fifty feet deep. If in this state the matter is drawn out with tubs or any machinery and dried on the surface about six inches thick, when partly dried, cut into squares of from four to six inches, it will be found nearly equal to sea coal for any use. There is undoubtedly a plenty of good peat, without using any of the top of the ground, (which is loose, spongy and half formed,) enough to last the country for centuries. The light parts or tops should be thrown back into the pit, after that fit for use is taken out; it will with the aid of aquatic plants be soon converted into good peat by the silent process of nature. No peat ought to be dug for fuel that is not when dried hard and heavy. Some roots will appear in such peat, but it ought to be considered good for fuel possessing these qualities, and of more importance than to use such land for agriculture. The Irish have long since determined that their peat bogs are of more value for fuel than they ever can be in a state of cultivation. These extracts have been

made with a desire to communicate to the public the nature and varieties of peat and the inflammable substances contained in the earth derived from vegetable matter, and to shew its uses for fuel or cultivation; which I submit to the Trustees of the Massachusetts Society for Promoting Agriculture to republish, if they think them of sufficient importance.

AARON DEXTER.

THOUGH peat exists, nay abounds, in every region of the north of Europe and America; though it is every day under the eye of the philosopher, the natural history and origin of this substance has been neglected for ages.

Lentilius and Commelinus suppose that Holland at one period was an extended forest, and that this was overflown by an inundation of the ocean; that of course the wood, thus overset, sunk in the mud, and by the accession of particles of earth deposited by the waters, formed the immense mosses of that country.

Moisture seems to be absolutely requisite to the formation of peat from these materials. Let a congeries of ligneous or aquatic plants be formed, if left dry, or not immersed in water, it never will be converted into peat. Such a mass indeed will, even in this case, undergo certain chemical changes, and form new combinations, none of them will be found to have the characteristic qualities of peat. When exposed to the influences of the atmosphere, it will undergo the putrid fermentation, and be reduced to vegetable mould; in this form it will be destitute of the distinguishing qualities of moss or peat, inflammability, tenacity and others. It is known, that all the deep mosses in Europe lie on level plains, where water must have stagnated; the very word moss, or peat, in the original Celtic language, implies this.

The subsoil of most mosses or peat is impervious to water; it generally consists of a stiff tenacious clay. Sometimes sand may be discovered under that substance; but though it forms the immediate subsoil, below it will be found a bottom of clay.

When peat is drained, it ceases to grow; the aquatic plants which furnished the materials for its original formation and subsequent increase no longer flourish, of course no addition to the peat is made.

But moisture alone is not sufficient for the formation of peat; it is further requisite for this purpose, that the water, in which it is immersed, be stagnant.

Most of the plants which contribute to the formation of *moss* or *peat*, are possessed of astringent, antiseptic juices, soluble in water. When such plants are therefore immersed in that liquid in a stagnant state, these juices must be diffused through it; of course it must be changed in quality, and differ from rain or river water. When a quantity of oak leaves, or bark, or wood, or even aquatic plants, drop into a pool of stagnant water, a change of colour ensues, and it acquires a bitter astringent taste, and an antiseptic quality. Aquatic plants, such as abound in peat, may flourish even in such a liquid, though no succulent herb will. By this means, a mass of vegetable matter may be accumulated, and, in the course of ages, that matter may be converted into peat, and still the water may possess the same astringent antiseptic quality; accordingly, it is a well known fact, that, in this respect, peat water differs from rain or river water, the latter when it is allowed to stagnate, especially in warm weather, becomes putrid; the former does not. Peat water converts all the vegetable matter immersed in it into moss, or peat. This is not the case with rain or river water.

Besides all the above requisites, a low temperature seems to be necessary to the formation of peat. It is superfluous to offer any proof of this, one fact is sufficient to establish it, viz. that no peat exists in warm climates, except on high mountains. It has seldom, if ever, been discovered between the tropics.

The only decisive evidence that the northern parts of Europe and Asia are colder now than at some former period is, that trees are dug out from under the perpetual snows of Lapland and Iceland, and even on the summit of the Alps and Pyrenees. That these trees grew on the spot where they now lie, cannot be doubted; and that no tree, nor vestige of vegetation, can now be traced in these regions, is equally certain. At the period, therefore, in which these trees sprung up and flourished, the temperature of the northern regions and lofty mountains must have been much milder than now, but that period seems to have been far more remote than the Saxon or even Roman age.

As vegetables, while placed in a vacuum, or secluded from the atmosphere, or the oxygen it contains, are not liable to the putrid fermentation, so neither can that process go on in a mass

of vegetables immersed in peat water or in a lake. In this situation, there is a superabundance of moisture, and as vegetable matter, when kept continually dry, does not undergo fermentation, so neither can that process take place, when there is a superabundant moisture, especially when there is no alternation of moisture and drought.

It is true, a considerable proportion of all vegetables, even of those ligneous plants, which are the most solid and compact, is soluble in water.

If the hardest and most compact wood be partly soluble, it is obvious, that a greater proportion of those plants, which are of a looser texture and contain a little or no ligneous fibre, must be capable of solution in this medium. The juices of many of these vegetables, it is known, may be speedily dissolved or diffused in water; the carbonic and gallic acids, and also tannin, which they contain, are of this description.

The same is the case in all lakes. Even in Italy and Switzerland, Peron found this was the case. Georgy, Gmelin, Pallas, Leydyard, and Patrin, observed that the lakes of Siberia, at a certain depth, were of the same temperature. At the same depths in the lakes of America, the temperature was observed to be the same, by Shaw and M'Kenzie. The ocean too, in all latitudes, whether in the torrid or frigid zones, has been found to be of a low temperature, at a certain depth; Irvine and Phipps examined it at 80° north latitude. Forster did the same in the opposite hemisphere, in 64° south. Peron examined it under the equator, and the result of these experiments on this extended scale was, that at a certain depth, the temperature of the sea was in all latitudes nearly the same, and uniformly low. In all these cases, the thermometer sunk in proportion to the depth. Forster found, that Reaumur's sunk from 16° to zero. Irvine says that it sunk 2° below zero at the depth of 3900 feet. The experiments of Ellis and Wallis, Bragley and Baldh, confirm the above account. The conclusion is obvious, that in the profound abyss of the ocean, even in the warmest climates, as well as on the summits of the lofty mountains, a low temperature uniformly reigns; and as few vegetables or animals can exist on the latter, so the former are probably destitute of fishes, as both are exposed to the same intense cold, and perhaps bound in perpetual ice.

The temperature of the mosses at the depth of two or three feet is almost uniformly low; it seldom exceeds 48°. Or if it rise above this, which is very seldom the case, it is owing to certain chemical agents, accidentally combined with the mass. If this point be established, we may more distinctly ascertain what are the chemical changes which vegetable matter undergoes, in such a medium and at a temperature so low. It is obvious to demonstration, there is a want of a sufficient degree of caloric, to carry on and complete the putrid fermentation; that process is arrested, in its primary stages, owing to the absence of this universal and powerful agent. The volatile particles of that matter can never assume the gaseous form, or be evolved at a temperature so low. It cannot be doubted, that the elements of vegetables may be set free from their existing combinations, even in such a medium. In the slow and silent process of nature too, they may combine anew, the oxygen of the water may combine with different bases to form acids; the hydrogen also may combine with the carbon to form oils, and these oils may form triple combinations with oxygen or acids, so as to assume the more concrete form of bitumens; but none of these simple elementary constituents, nor the compounds they form, can assume the gaseous state; no evolution of these can, therefore, take place in a temperature so low.

The residuum of vegetable matter, in the medium of water, must be very different in its chemical qualities from that of the same matter in the medium of the air; in the latter case, it must undergo all the stages of the putrid fermentation; and during that process, the vegetable acids, oils, gums, and resins, must disappear; the elementary principles that are volatile, must escape in the form of gas. In the former medium, and at a temperature so low, no such process can be accomplished, and no such evolution can take place. Though the same vegetable acids existed in both, and though the carbonic acid may be formed in the medium of water, as well as in air, that acid is not evolved, nor does it assume the gaseous form till the temperature rises considerably. It is never entirely dissipated from vegetable matter, till the temperature reaches to 80°. The hydrogen and carbon of vegetable oils is never discharged, in the form of gas, till the temperature rises as high, or higher, than the latter. As moss seldom or never rises above 48°, excepting on the surface, it must, therefore, still possess all these

elementary principles and differ essentially, on this account, from vegetable mould, though it be originally composed of the same materials.

It must be more inflammable, because it contains more hydrogen and carbon; it must be possessed too of more acidity, as the vegetable acids have not been expelled, and it must be more tenacious and insoluble when dried, in consequence of the combinations formed by these elementary principles. These are, of course, the very qualities by which moss is distinguished from vegetable mould, and these qualities depend on the medium and temperature in which the vegetable matter has been placed. It is true, indeed, that the surface of all moss is exposed to the alterations and transitions of the climate and all the influences of the atmosphere; but it is equally true, that in all latitudes where moss is found, it is, on this very account, unfit for fuel; it is never so highly inflammable as the rest of the moss which lies deeply immersed; it is certain, that in those climates where a high temperature reigns, or where the above alterations are great and rapid, the surface of the peat is useless to a greater depth as a fuel than in colder regions, where such alterations are not so great or rapid. In a low, warm sheltered valley, there is a greater depth of surface deprived in a great degree of inflammability, than on lofty mountains in the immediate vicinity. In the north of France, the surface is more inflammable than in the south, yet, even in the latter, fifteen inches below the surface, moss is found possessed of all its distinguishing qualities.

The reason of this seems to be, that at the above depth it is not exposed to the high temperatures of summer and to the sudden transitions of heat and cold of the other seasons, which would be sufficient to make the hydrogen and other volatile particles assume the form of gas; therefore the putrid fermentation is not completed, as it is nearly on the surface.

One circumstance more may be mentioned on this point, viz. that the more loose, open, and porous, the surface of any peat is, it must be deprived of inflammability by the above means, to a greater depth; on the contrary, such as are solid and compact and almost as hard as coal on the surface, must be less exposed to the above agents. It is certain, however, that even coal itself, when exposed to the air, is, in course of time, stripped of its inflammability, or oxygenated as well as peat.

When a mass of vegetable matter is thus secluded from the influences of those powerful agents which promote and accomplish the putrid fermentation, when it is shut up from access to the atmosphere and the oxygen it contains, when it is overcharged with moisture and never exposed to a sufficient degree of caloric, nor to those transitions which have been spoken of, that process cannot be completed.

In general, it is obvious that in such circumstances, there can be little or no evolution of the volatile particles of vegetables in a gaseous form; the residuum, therefore, must be very different from that of the same vegetable matter exposed to the atmosphere, and all the chemical agents to which it is exposed in that medium.

In the first place, less of the carbonic acid which that matter contained, can be evolved in the medium of water than in that of the atmosphere; in the latter stages of fermentation, that acid is almost entirely expelled. But it is only in the ultimate stages that this takes place; in the commencement of it no such evolution is accomplished, nor can it be till the temperature is raised to a considerable height. From the foregoing statement it appears, that moss peat or vegetable matter, immersed in water, seldom or never rises to this pitch; of course, this acid never assumes the gaseous form, on account of the low and equable temperature in which it is placed. On the contrary, having a strong affinity to water and being soluble in it, it must be diffused through and incorporated with all the mass of vegetable matter that comes in contact with it.

The mosses and mossy lakes are all strongly impregnated with carbonic acid. By the rays of the sun, the oxygen it contains being set free, the soluble carbon is of course precipitated. Uniting with the hydrogen, to which it has a powerful affinity, it must form a kind of oleaginous, inflammable matter. The fine soft pulpy substance, found at the bottom of such lakes, and so highly inflammable, is probably formed in this manner; hence it is destitute entirely of organization.

That this process is going on in lakes and marshes, we may learn from the following circumstance. It appears that aquatic plants, even in a growing state, and immersed in water, are robbed of their oxygen by the light of the sun. It rises, of course, in bubbles to the surface; if a cloud intervene or night ensue, this operation ceases. The quantity of oxygen which they yield

is in proportion to the carbonic acid contained in the water or the plant, and the length of time to which they are exposed to the light.

By the above changes and combinations, there must be a constant accession of hydrogen; for, while these aquatic plants discharge oxygen in the light, they greedily absorb and retain hydrogen. Rosier observes, that this is a wonderful provision in nature; by the exhalation of the former, and absorption of the latter, the air of such mosses is always salubrious; for, as the carbonic acid is not evolved, on account of the temperature of the moss being low, so neither is the hydrogen. By this means, the air is never infected with these deleterious gases.

Carr, in his Stranger in Ireland, mentions, that this is the case in that country. Dr Walker makes a similar remark; he says, "stagnant rain water, especially in warm weather, occasions in fenny countries intermittent fevers and putrid diseases; whereas, no such effects are felt from stagnant moss water." The moors and mosses in Scotland, and the turf bogs in Ireland, are inhabited by as healthy people as any in the world. No intermittent fevers, no putrid sore throats, prevail among them. M. de Luc makes the same remark; he says, "Over the whole continent of Europe which I examined, the air of the mosses, even in the lowest vallies, is very salubrious; the inhabitants of these districts are remarkably healthy—they are not liable to the *fever and ague* which prevails in other low level lands in their immediate vicinity, where there are no mosses." The oxygen they discharge must purify the air, and promote the health of those who inhabit such districts.

In warm climates where the putrid process goes on with rapidity no peat is ever formed, though the same materials abound, and the air is for the above reason noxious, and the inhabitants a sickly race of beings. Rosier observes, "that in Bresse Bressante, the oldest man in a parish does not exceed fifty years."

Dr. Jackson, in his account of the fevers that prevail in Jamaica, makes a general remark to the same effect; he says, "in warm climates, especially in the heat of summer, the air of low marshy lands is pestilential;" this he ascribes to the exhalation of noxious gases, during the process of the putrid fermentation. Hence he observes that some districts are healthful in winter and autumn, which are absolutely pestilential in summer.

As peat exists only in the temperate and frigid zones, as it is uniformly in a low temperature, no such consequence can take place. No such deleterious gases are discharged; of course, the air is uniformly healthy. Such seem to be the changes and combinations, which vegetable matter undergoes in the medium of water. By these means, the elementary principles of that matter must be set free, and again combine anew. On this account, it is natural to suppose, that, as few or none of these are dissipated in gas, we may expect to find them all in their simple or compound state in peat. Where fuel of all kinds is scarce, and little or no coal is found, it is of vast importance to prevent the waste, and promote the renovation of peat moss. The north of Scotland and the whole kingdom of Ireland, are of this description. In the former, no coal has hitherto been discovered; and in the latter, it is only found in one or two districts. The value of peat, as a fuel, to both these parts of the empire is great, and it must appear still greater, when it is considered that there is at present a scarcity, even of that article, in many parts. "Fuel is so dear, in the province of Ulster, that while peat can be got for that purpose, it cannot be worth any man's while to employ moss or peat land for the purpose of agriculture." The same scarcity of fuel seems to be felt in the south as in the north of Ireland. The secretary of the Cork Institution mentions this in one of his letters; "we have no bogs in this country which we wish to be reclaimed, as they are barely sufficient for fuel."

Peat ought never to be dug in forests, or open casts; for, in this case, when the water is drained off, there is no renovation of peat. It ought always to be dug in pits, and the smaller these pits are, the more rapid is the process of renovation. These pits should never be left dry; the moment the peat is dug, they should be allowed to fill up with peat water. Without this, there can be no renovation of that substance. In digging the pits, care should be taken to leave a little peat in the bottom—in no case ought the subsoil to be left bare. In every situation where moss is renovated, this rule holds true, that when the water is only shallow, (i. e. about two feet deep) the renovation of peat is more rapid than when it is deeper. No current of any kind ought to be allowed to pass through these pits.

After the whole moss is pitted, the interstices, or subdivisions, may then be cut into peat; and before this be exhausted, the

new formed peat will be ripe, and may be cut in the same manner.

By following these simple and obvious directions, a peat bog may be used as a copse of wood, and furnish a perpetual supply of fuel to succeeding ages.

The dark coloured compact peat, in which no organization of the original vegetable can be traced, may have led some to conclude, that the putrid fermentation has taken place in that species—the decomposition is indeed complete—and the elementary principles of which it is composed may have been as completely separated, as if it had been analyzed by distillation, or putrefaction; still it does not follow that it has undergone the putrid fermentation. For the great, the necessary agents in that process have been wanting; the influences of the atmosphere, and still more, the degree of caloric, and the alternations requisite to carry on and complete this fermentation, have not combined with the peat, or co-operated to effect such a change.

Mr. Parkinson calls it a fermentation peculiar to vegetable matter, placed in such situations as not only to exclude the external air and secure the presence of moisture, but to prevent the escape of the more volatile principles, and which terminates in the formation of those substances called bitumen. The oxygen of the carbonic and gallic acid, being attracted by the light of the sun and other agents, the carbon they hold in solution may be thus set at liberty. This carbon has a powerful affinity for hydrogen; and uniting with it, a kind of oily compost may thus be formed. A third combination occasions another change; for when oxygen combines, it gives this oily compost the concrete form of bitumen. This oxygen may be furnished by the decomposition of the water, or the acids with which it is impregnated. Thus the result of the whole will be a black insoluble compound, destitute of organization, but highly inflammable. The black pulpy peat at the bottom of lakes and marshes, (which by some has been called perfectly putrid) seems to have been formed by this or a similar process, and this appears to be the first stage. Aquatic plants promote the formation and renovation of peat. No doubt the formation of moss is going on during the growth of such plants; as however, those plants and that water, which contains the greatest proportion of the above acids, emit more oxygen, and of course yield more soluble carbon; and, as these acids are continually accumulating by the

rapid growth of such plants, this process must become proportionably more rapid; for, when the waters become doubly astringent, they must yield a double proportion of materials for the formation of moss in a given time.

Ligneous plants contain nearly a fifth part of their weight of carbon. Even in aquatic a considerable proportion exists in both—it is the same elementary substance. Being nearly incorruptible, it must therefore abound wherever vegetables are decomposed; and where that decomposition is complete, and the organization of that vegetable matter is totally destroyed, (as is the case in some kind of peat) the whole of the carbon of the recent vegetable must be deposited. Though set free from its former combinations it is not evolved, it must therefore form the chief ingredient of such a mass. Hydrogen also exists in every vegetable—it constitutes one of the elementary principles of all the essential oils, gums and resins of every plant, whether ligneous or aquatic. Being specifically much lighter than atmospheric air, it is apt to assume the form of gas. In this form, part of the hydrogen of the recent vegetable in peat may have escaped, but immersed in water, and placed in a low temperature, the proportion that is evolved must be small—by far the greater part must remain.

On the surface of peat, the organization of the plants of which it is composed is often entire. That organization becomes fainter and fainter, as we dig down to the bottom, where it almost or altogether disappears. Though few substances are more dissimilar in appearance, than the fibrous peat on the surface, and the solid black peat dug out from the bottom, this is no proof that they are of different origin. On the contrary, as the former is altogether composed of vegetable matter, it appears reasonable to conclude, that the latter may be traced to the same source; more especially, as the most compact peat, when diluted in water and examined by a microscope, discovers the most distinct traces of its fibrous texture. Though the origin of the latter appears doubtful, as that of the former is decisive, it is more reasonable to ascribe both to this source, than the one to vegetable, and the other to mineral origin.

If vegetable matter be detected, even in the most compact peat, in a distinct state of organization, it is as reasonable to conclude that this species is of vegetable origin; as the most fibrous peat, in which every plant, of which it is composed, may be found

in its original organic form. But if this position be well founded, and if this analogical reasoning be conclusive, it may be pursued much farther than in peat moss. For surturbrandt coal, and even jet, often contain vegetable matter in an organized state: we may therefore, on this account, trace them to the same source. In these substances, indeed, the traces of vegetable matter are fewer and less decisive; for peat is obviously of more recent origin than any of these substances—its origin and natural history must therefore be preserved. The records of the other bituminous substances mentioned must be lost in the lapse of time. The general hypothesis is, that there is a clear and decided alliance between peat, surturbrandt, coal, and jet.

Surturbrandt and Bovey coal certainly constitute a species of matter different from peat moss: they have therefore generally been supposed to be of mineral origin. The alliance between them and peat has never been distinctly traced. Some distinguished authors seem even to doubt of this alliance.

Other authors have supposed that Bovey coal belongs partly to the mineral and partly to the vegetable kingdom. Brochant, in his mineralogy, seems to maintain this opinion. He says, that "it is half mineral and half vegetable;" and he adds, that "Walter calls it *vegetabile fossile bituminosum*. Brongniart thinks that "it is more a vegetable than a mineral substance." He observes, "that it ought not to form a variety in the system of minerals, if it did not, by insensible degrees, graduate into those varieties which precede and follow it"

This insensible gradation is one of the most interesting and curious subjects in geology; but it appears to be no conclusive argument against the vegetable origin of Bovey coal. On the contrary, as the same gradation may be observed in peat moss, it seems to corroborate this conclusion.

Bovey coal seems only to be advanced one step further than compact peat, in the process of bituminization. The former often bears more evident traces of vegetable origin than the latter. In the former, these traces are so palpable and frequently so obvious, that they can be clearly seen by the naked eye; in the latter, the organization of the vegetables of which it is composed is sometimes so entirely gone, that it can only be detected by the aid of a microscope.

This however is not always the case. In some specimens of Bovy coal there are no traces of vegetable organization, though

in others they are obvious and entire. Werner accordingly supposed that there were two distinct species of that substance. Brochant however observes, "that they are linked together by such an insensible gradation, that the one is only a modification of the other." In this respect there is a general alliance between peat and Bovey coal. In both there are the same gradations and in both the same difference. Compact peat bears the same resemblance to fibrous, as Bovey coal, with organized vegetables in it, bears to that which contains no vestige of organization. But this alliance may be traced still more clearly; for if it can be shewn that wood is detected in Bovey coal, in its original organic form; if all the different parts of ligneous plants, such as the roots, stems, branches, bark, leaves, and fruits, be detected in Bovey coal as well as peat; still more, if part of the same tree has been discovered in its original state, and another part be converted into Bovey coal, and if similar aquatic as well as ligneous plants have been discovered in each of these substances, the alliance that subsists between them must appear obvious.

The wood of which surturbrandt seems to be composed is often, if not generally, found in its original organic form. The annual rings, which mark the growth of the original plant, may often be traced These always assume the elliptical form; this may be owing partly to compression. And no Bovey coal has been discovered, but what has obviously been subjected to mechanical pressure from the superincumbent strata uuder which it lies. It is, however, principally owing to chemical causes; the wood has probably undergone certain changes, by which it has been softened so as to yield to compression. Trees are often discovered in peat moss in this soft plastic state; they are so changed by chemical agents that they are nearly as soft as a piece of peat; and if such trees were exposed to similar pressure with that to which all Bovey coal has been subjected, they would certainly assume the same elliptical form.

All the different parts of the original wood have been detected in surturbrandt. The roots, stems, branches, knots, bark, even the leaves, have been found in an organized state. Professor Hollman speaks of many specimens of this description, that have been dug up near Munden. He says, "the distinct traces of the very leaves were visible." M. de Luc mentions, "the wood dug out of Messner resembles in every

respect that which may be found in a ruined forest, or is dug out of peat bogs. I have seen these trees in large heaps, lying on the spot. The stems, branches, and roots, may be distinctly seen."

Sometimes part of the same tree is found in its original state of wood unchanged, while other parts of it are so highly bituminated and so much changed, that they can scarcely be distinguished from coal, excepting by their organic structure. Bomare mentions an oak tree, found in digging the foundation of the walls of Nanci, fifty feet long and five in diameter. He says, that it was as black as ebony, yet very sound, excepting some knots which were changed into a kind of fossil coal.

The traces of aquatic plants are visible in surturbrandt, or the strata that accompany it, as well as in peat. Parkinson observes, that "the clay or schistus, which intervenes between the strata of Bovey coal, is often found to contain vegetable impressions of reeds and grasses."

These are some of the aquatic plants that enter into the composition of peat moss. If these facts be well ascertained, no doubt can remain of the vegetable origin of Bovey coal and its alliance, in this respect, to peat moss. The chief difference between these two substances seems to be, that the former contains chiefly, if not solely, the remains of ligneous plants; and that these are more completely bituminated and consolidated than the latter. In all other respects the resemblance is so obvious and entire, that little doubt can remain of their being formed of the same materials, and by a similar process. To ascribe the one to vegetable, and the other to mineral origin, would therefore appear unreasonable.

Pit coal appears to be the next in the order of bituminated substances. In many respects it is homogeneous with peat and surturbrandt; and there are strong reasons to conclude, that it also is of vegetable origin. A few facts and circumstances which lead to this conclusion, may be mentioned; many others must occur to the intelligent reader. And it is believed that no solid objection can be stated against this hypothesis, which may not be obviated on similar principles as those respecting the origin of peat moss.

The traces of ligneous plants are frequently detected in the strata of coal itself. Specimens of this kind may be seen in the cabinets of the curious; and there are very few coal strata

utterly destitute of them. The conclusion from this is obvious, that ligneous plants have existed in, and contributed in part to, the formation of coal as well as peat.

Mr. Williams who had the best means of information, and the most extensive opportunities of examining coal mines, is decidedly of this opinion. He says, that wood "is so obviously the origin of coal, that he could almost trace and point out the particular species which furnished the materials for varieties of that substance."

As wood has been discovered which was partly converted into peat, so have similar specimens been found in coal. Mr. Playfair, in his luminous work, mentions that in the Isle of Skye, pieces of wood have been found, one end of which remained still in its original organic shape, and the other had been converted into coal, in which there was no vestige of organization. Mr. Brand, in his history of the antiquities of the town of Newcastle, speaks of similar specimens that have been found in Ireland. He says, that "the top of the tree was still wood, while the bottom or root was converted into coal."

Some ligneous plants have been discovered in such an entire state of preservation in that substance, that the species to which they belonged could be ascertained. Chaptal says, that "the bamboo and banana tree have been detected in the coal of Alais."

All the other parts of ligneous plants, as well as the trunks and roots, have been discovered in a state of partial or total bituminization. The bark of trees appears to undergo this change sooner than the trunk; of course, it is for the most part converted into coal, even while the trunk remains entire. Yet in some instances, in coal as well as in peat moss, the bark is found in its original organization. Mr. Brand mentions an instance of this; while part of the tree was converted into coal, the bark was found adhering to the other part. The leaves are still liable to change.

If the above facts be correctly stated, we must conclude, that the tenderest and most delicate parts of vegetable matter may be detected in coal as well as in peat; nay, more, that these have contributed to the formation of the former as well as the latter. This corroborates the general conclusion, that coal is of vegetable origin.

Mr. Hatchett observes, that "next to the ligneous part, the resin of trees is that substance which most powerfully resists

any change; but when this change is effected, it is the substance from which bitumen is more immediately formed. It not only contains the greatest proportion of the elementary principles of that substance, but it is nearly allied to it; the resin that remains in its original state in the resino-bituminous matter, above mentioned, must be regarded as a part of the proximate principles of the vegetable, which has not yet undergone the necessary change. The bituminous matter, on the contrary, seems to be the product of the same principles, after this change it accomplished."

This appears, therefore, to be the link which unites bituminous to vegetable, or it is the link which unites the vegetable with the mineral kingdom. It therefore claims more particular attention. That attention has been paid to it by the justly celebrated Mr. Hatchett. His experiments set this point in the clearest light, and establish the affinity which exists between bitumens and the recent vegetables.

If we thus discover a vegetable substance, which appears to be in a progressive state of bituminization, this becomes a presumptive proof, that all bitumens are of vegetable origin; not only those which contain organized vegetable matter, but even those where the organization is destroyed. The resins and gums of trees may have furnished materials for the latter, while the fibrous woody part has contributed to the formation of the former.

The gradation may be traced distinctly in all its stages. In Bovey coal, and especially in the substance which accompanies it, nature seems only to have performed one half her work; one half nearly being still a vegetable resin, and the other a bituminous substance. In asphalt that process is still further advanced. In cannel and pit coal it is nearly completed, and in the elastic bitumen of Derbyshire no trace of vegetable resin can be discovered.

The next in the order of bituminous substances is jet. The alliance between it and peat is a step further removed; it must therefore be more difficult to trace it clearly, as in peat moss, the deeper we dig, we generally discover fewer vegetables in an organized state, and its origin becomes less conspicuous; so is it in other bituminous matter. In surturbrandt it is more obvious than in coal, and in coal still more obvious than in jet; yet even in this last substance, where the change is most complete, we may discover distinct traces of its vegetable origin.

As in peat, surturbrandt, and coal, trees have been discovered, partly changed into these substances, and partly in an unchanged state; so the same discoveries have been made in jet. Chaptal mentions an instance of this; his words are, "I preserve in the cabinet of mineralogy of Languedoc, several pieces of wood, whose external part is in the state of jet, while the internal part still remains in the ligneous state; so that the transition from the one to the other may be observed."

It is, if possible a still clearer evidence of the vegetable origin of jet, that specimens have been discovered, in which one end of the same tree was converted wholly into jet, while the other remained in its original state. Fourcroy mentions instances of this; and Chaptal says, that "in the environs of Montpelier, several cart loads of trees have been dug up whose form was perfectly preserved, though entirely converted into jet."

Utensils of wood have been discovered converted into jet. "I have," says Chaptal, "found a wooden pail converted into this substance." He likewise mentions a wooden shovel which had undergone the same.

Thus, the alliance between peat, surturbrandt, coal, and jet, may be traced. In the first of these substances, the trunks, roots, branches, bark, leaves, and seeds, of ligneous plants may be all distinctly seen, nay, every species of aquatic plants, of which it is partly composed, may be discovered in a distinct, entire organic form, where the smallest seeds and capillary tubes may be traced. In the second, only ligneous plants have been detected; yet all the parts of these in a partial or entire state of organization may be detected. In the third, the same discoveries have been made; nay, even in jet itself, there are specimens which exhibit distinct marks of organization as in coal; in neither of the two last mentioned have aquatic plants been often detected.

It is certain, that the softest and most porous peat, by mechanical pressure alone, may be converted into hard. Poiret takes notice of this; he says, that fibrous peat moss, though light and loose, may by this means be hardened to such a pitch, as to receive a polish like wood.

It is equally certain that peat, however soft and pulpy when dug, if ground and compressed in the manner in which the Dutch form their peat, acquires the density of, and becomes specifically heavier than, coal.

Some peat when dug, even without this mechanical pressure, becomes so hard, heavy, and so glossy in the fracture, that it is with difficulty it can be distinguished from some of the softer coals. On the contrary, Mr. Williams says, that he has seen coal so soft, that it was with difficulty it could be distinguished from the hard, black, glossy peat.

There are the strongest reasons for supposing, that all coal has been, at one period of its formation, in a soft pulpy state, like the above species of peat when newly dug—that coal, wherever it has been discovered, has certainly been exposed to a degree of mechanical pressure, far beyond that which ever was applied to peat by art. It would be superfluous to offer any proof of this; and if the best peat was subjected to the same degree of compression, it is obvious, that it would become equally compact and equally heavy, bulk for bulk, and equally as inflammable as coal; in no respect distinguishable from that substance, in colour, consistency, or chemical qualities.

Sir James Hall, whose experiments on this subject have so justly excited attention, says, "I have not made any experiments on peat with heat and compression; but I have little doubt that coal would be so produced, as well as from every animal and vegetable substance. I have always looked upon the peat of the old world, as one of the principal sources of our coal."

The chief difference that subsists between the hardest and most compact peat and coal seems to be, that the former contains more water and more acid than the latter. Bulk for bulk, they often contain nearly an equal proportion of bitumen; compression alone might remove this difference. It is not insinuated, that this is the case with every species of peat and coal; but that the former may be converted, by means of compression, into the latter, appears certain.

Most probably it is in this way, that all coal, strata, and surturbrandt, have been originally formed. A ruined forest or a mass of vegetable matter, such as is contained in moss, may have been overwhelmed by a current of lava, or overrun by a bed of sand, or argillaceous or calcarious matter, or buried in the caverns of the deep by the flood; in all of these cases, this matter must have been subjected to such a degree of compression, as is sufficient to consolidate it into a substance like coal or surturbrandt.

The external appearance of coal shews its alliance to peat, in colour and consistency; the resemblance is often clear.

It is however, a presumptive proof of the vegetable origin of peat, surturbrandt and coal, that all of them, by distillation, afford nearly the same elementary principles with vegetables, viz. air, water, an acid, an oil, salt, and earth ; and though the proportion of these ingredients may differ in these substances, and even in different species of each of them, yet the elements of which they are composed are not only the same, but are evolved in the same order.

There are many other circumstances which shew the alliance between peat and coal—suffice it only to name a few of these.

Both coal and peat are of a laminated texture—in the latter, these laminæ may be seen with the naked eye—in the former, they are frequently as conspicuous—in both, there are a few exceptions to this. Some peat and some coal are utterly destitute of this external appearance.

The more moisture accompanies both, the more they are inflammable.

The lowest strata in both are generally most inflammable, and most impregnated with bitumen ; to this there are very few exceptions in either. The surface of most species of peat is generally possessed of little bituminous matter, and of course, less inflammable than the substrata. The *out burst* of all coal is possessed of less inflammability than the rest of the seam.

Both are supposed by some to be renovated when dug : of the renovation of peat moss little doubt can be entertained—that of coal seems probable. Mr. Gannelo says, " he was an eye witness of the fact ;" he describes the manner in which coal is renovated in the Liege mines—" a bitumen impregnated with carbon transudes through the veins which form coal ; in forty years the wastes are filled up with it." He says he saw this new formed coal.

Moisture seems to be requisite for the renovation of both ; hence the common saying, that water is the mother of coal ; the same may be said of peat.

Both are stripped of their inflammability and tenacity, and other distinguishing qualities when long exposed to the air, and the alternations of heat and cold, moisture and drought. They both crumble down into powder and cease to be inflammable.

Some peats are highly bituminated, and emit much flame ; others burn with difficulty, and yield little or no flame. There

are also what is called blind coal, corresponding to the last, and cannel coal, yielding flame like the first.

As all the distinct species of peat graduate into each other by such insensible shades, that it is difficult, if not impossible, to draw a distinct line of separation between them, so the same is the case with all the varieties of coal.

These and many other circumstances, led Mr. Williams to make the following remark: "I have seen strata of coal that bore all imaginable marks of being composed of wood; the colour, the quality, the stratification, the manner of burning, the ashes, and every thing else looked like peat."

There are in moss materials in abundance for the formation of bitumens; the elementary principles of these substances are known. Hydrogen and carbon constitute the ingredients of all bituminous matter. Sometimes a portion of azote and oxygen enter into the combination. The latter, by its action on the other ingredients, makes the whole assume a more concrete and solid consistency.

Hydrogen and carbon may be considered as the chief ingredients of all bitumens, whether solid, fluid, or æriform. That these abound in peat moss has been already shewn. But in order to the formation of bitumen, the carbon must be in a soluble state.

The carbon contained in the acids which exist in peat is already in a state of solution; and if set free from its combination with oxygen, it is prepared to enter into combination with hydrogen, and form bituminous matter. That carbonic acid must have existed in all masses, at one period of their formation, cannot be doubted—that there is a perpetual accession of it, during the whole process, seems highly probable.

But not only is the carbon, which this acid contains, already in a soluble state, but all that which exists or existed in the gallic acid, while the vegetable matter was in a recent state, must be of the same description. As oils may be converted into resins, so may both be changed into bitumens. When transparent oil of turpentine, which resembles naptha in appearance, is mixed with a small portion of sulphuric acid, it is converted into a substance like petroleum. With a greater proportion of the acid it assumes the black tenacious appearance of Barbadoes tar, and the mixture may be so adjusted as to acquire the consistency of asphalt. In these cases, it is the accession of the oxygen in the acid that op-

erates this change. That such a change has taken place in the resins, gums, and oils, which exist in the vegetables of which moss and surturbrandt are composed, appears highly probable from this circumstance, that a resino-bituminous substance has been discovered in both.

That carbonaceous matter exists in a state of solution in the acids, and vegetable extract of moss is evident Till this carbon be set free from its combination with oxygen, and precipitated, it is not likely that it can enter into such a combination with hydrogen, so as to form bituminous matter.

The essential oils of vegetables must also undergo certain changes, before they can be converted into bituminous matter. It is probable, too. that before these changes be accomplished, these oils must become soluble in water.

The resins of the recent vegetable are still more insoluble than the oils ; yet it appears probable that they undergo solution before they are coverted into bitumen.

Even the acids, which exist in all moss, may operate to effect these changes. Mr. Hatchett shews, "that the acetic acid acts as a solvent of gums and resins, without altering their properties." Senebier found, "that the carbonic and gallic acids act in a similar manner."

Carbonated hydrogen gas may be considered as a species of bituminated matter ; it consists of the same elementary principles with the liquid and solid bitumens. The illustrious Dr. Black accordingly classed it among those substances, and he called it by its proper name, bitumen in a gaseous or aeriform state.

This aeriform bitumen, if prevented from flying off in a gaseous state, and collected in a refrigeratory, may be converted into a pure bituminous oil, like naptha.

Mr Hatchett says, "that bitumens owe their origin to the organized kingdoms of nature, and that there is almost unquestionable proofs that they are produced by the modification of some of the proximate principles of vegetables, especially of resins.

Upon the whole, we may conclude that "there is no occasion to ascribe the formation of moss merely to the deposition of matter by wind or water, or to crystallization, or to congelation, or refrigeration, or to exudation and subsequent concretion, or to an accumulation of animal matter, but to an accumulation of vegetable matter, by a process which is natural, and obvious, and easily accounted for, and to the various changes and combinations

which that matter has undergone in the medium of water in which it has been immersed; and that all the varieties of liquid, solid, and aeriform bitumen may be considered as allied to peat, and of the same origin."

The general conclusion, to which all these facts lead, is, that peat, surturbrandt, coal, and jet, are all homogeneous, and may all be traced to the same origin; and that they are all formed of vegetable matter, by one and the same process. Even in the softest peat, that process is begun—in the more compact species, it is advanced a step further—in surturbrandt, it is still nearer its completion—and in coal and jet, it is accomplished.

It is superfluous to offer any proof that inflammability is one of the distinguishing qualities of peat moss—this is acknowledged by all. Some species of peat, if once kindled, will burn for weeks or months with unabated fury. Dr. Anderson says, that the fire, drying the surface of the quick moss, penetrates deeper and deeper, till it sometimes goes six or eight feet deep before it stops.

Hydrogen exists in every vegetable, of which that substance is composed; it is one of the elementary principles of all the essential oils, gums and resins. Immersed deep in water or moss, where a low and equable temperature reigns, little or none of this hydrogen assumes the gaseous form, or is evolved in that state.

Peat, when newly dug, is soft, spongy, and pliable; yet after being exposed to the air and dried, it becomes a hard tenacious mass, insoluble in water: in this state it is somewhat elastic, and will bend before it breaks.

The more bitumen any peat contains, when newly dug, the more insoluble and impervious to water it becomes when thoroughly dried. Light, loose *flaw peat*, recently formed, imbibes water much more readily than the solid black peat—the former contains much less bituminous matter than the latter. And as all the bitumens repel water and are impervious to and insoluble in that liquid, is it not highly probable that they are the cause of these qualities in peat?

Though a piece of dried peat is thus impervious to water, yet when it is distilled, and by that means deprived of the whole, or the greatest part of the bitumen it contains, it becomes equally pervious as a similar mass of vegetables.

Another distinguishing quality of moss is, that no living animal exists in it.

There must, therefore, be some quality in the moss or moss waters, which is unfavourable for nourishing animal life, if not fatal to it.

Vegetable acids in moss are probably one cause why it is fatal to animal life. The carbonic acid which existed in the vegetable matter, or which has been formed in the first stages of fermentation, may be one cause; it is certainly deleterious to fishes. Mr. Hunter has shewn that they cannot exist many minutes in it.

The hydrogen too, contained in the vegetable matter of moss, may be another cause why it is deleterious to animals.

It would appear that the vegetable acids and hydrogen which abound in all mosses, and the mineral acids which exist in some, and the combinations formed by these substances, are sufficient to account for this distinguishing quality.

And if the same proportion of these existed in mould or any vegetable matter, it must on that account be equally deleterious.

Peat moss, in its natural state, is almost entirely barren; no grain of any kind can be reared on its soil, and few grasses fit for the use of cattle grow on it. Though entirely composed of vegetable matter, and though that matter, when it has undergone the putrid fermentation, forms the richest of all soils and an excellent manure, yet while it remains in the state of moss, and possesses all the distinguishing qualities of that substance, it is unfit for either of these important purposes.

The vegetable matter of which peat moss is composed cannot undergo the changes requisite to convert it into a fertile soil. Senebier justly observes, that whatever retards fermentation is equally unfavourable to germination and vegetation.

If peat moss, therefore, be vegetable matter arrested in the early stages of the fermentative process, and vegetable mould the same matter in which that process is accomplished, may not this be one reason why the latter is so fertile and the former so sterile?

Senebier has shewn by experiment, that no grain will germinate in pears and apples when they are nearly rotten; and it is known, that when certain trees are suffered to decay on the surface of the richest soil, the juices that exude from them render it sterile for a considerable time. Abbé Rosier observes, that wherever a peach tree is permitted to perish it vitiates the soil, and before another be planted in its place it is necessary

to renew the earth to the depth of three or four feet. It is equally certain, that the liquor taken from a tan pit or the juice of any tree which contains gallic acid and tannin is equally hostile to vegetation.

There are certain gases detected in moss, which may be another cause of its sterility.

Hydrogen, for the reasons assigned already, abounds more in moss than in vegetable mould. Though composed of the same materials, it is known that this gas is pernicious to living vegetables, at least in its simple state, or when it abounds too much.

Senebier has shewn by experiment that no grain will germinate in it.

Peat moss is destitute of that mixture of different earths, which enter into the composition of other soils. Most fertile soils contain a proportion of the following earth, besides vegetable matter; silicious, argillaceous, and calcarious earth. For the most part, few of the peat mosses contain such a mixture.

That the mechanical structure of peat in its natural state is hostile to vegetation, cannot be denied; and till this be removed it will remain sterile. That it becomes often too light, loose, and porous, after being reclaimed, and by this means too wet at one time and too dry at another, as a soil, is equally certain.

From the foregoing view of the subject, we may conclude that the following causes may be assigned for this quality.

First, That the vegetable matter, of which peat moss is composed, has been secluded from the atmosphere.

Secondly, That on this account that matter has been arrested in the early stages of the fermentative process.

Thirdly, That the vegetable acids and extractive matter that abound in it are hostile to vegetation.

Fourthly, That the various gases with which it is impregnated are equally unfavourable.

Fifthly, That the bituminous oil it contains may occasion sterility.

Sixthly, That the mineral acids, and seventhly, the salts they form in some mosses, are the chief causes of this quality.

That all peat moss is more inflammable, more antiseptic, more tenacious, and contains more acidity than vegetable mould, though originally composed of the same materials, is true; that it is also more deleterious to living animals, and much more

sterile as a soil than that matter. But all the varieties of bitumens, whether solid, liquid, or aeriform, are possessed of the same qualities—all are inflammable—all operate as antiseptics—all are of similar colour—all are tenacious—all are hostile to animal life, and all of them occasion sterility; even in this view of the subject, therefore, the alliance between peat moss and bituminous matter may still be traced. This consideration corroborates the conclusion, that they are homogeneous in their origin.

Though all peat moss be of vegetable origin, yet the situations in which it is formed, the plants of which it is composed, and the state in which it is found being different, it is reasonable to expect that one moss should differ from another in its appearance, qualities, and the uses to which it may be made subservient. This difference may be often detected by the naked eye, whether the moss be in the pit, or dug and dried, or burning, or reduced to ashes.

The various colours that substance assumes, and the external appearance of it, mark the difference. Some are of a bright yellow colour, others brown, or jet black; some are composed of a congeries of vegetables in an organized state; in others, few or no traces of organization can be seen. Clay, sand, and shells, may be detected in some; in others, no such mixture can be discovered. Some are soft and greasy, like butter, and form a hard, brittle, tenacious peat, almost like coal; others are loose and friable like mould. The water squeezed out of one moss is of the colour of amber; of another, of claret or port wine; and of a third as black as ink. In some cases this water effervesces with chalk, in others not. Sometimes it leaves a copious sediment by evaporation which is highly inflammable; in other cases the sediment is small and scarcely inflammable. Some are covered with a rich luxuriance of aquatic plants, others are utterly bare, barren, and destitute of vegetables on their surface.

Poiret has made a distinction of this substance into two kinds; he calls the one fibrous, the other compact. As this distinction seems to be well founded, it may be proper to state it fully, and to attempt a description of both these varieties.

Fibrous moss is composed of the roots, stems, and branches of marshy plants; of course, the moss is a loose, light, porous, elastic substance, retaining the plants of which it is composed, in their original organized state.

The characters of this genus are sufficiently marked and may be easily distinguished.

When lying in its natural state it is always a soft, porous, spongy, and very elastic substance, composed of a variety of plants in an organized state. The roots, stems, branches, and leaves, and often the seeds of every species of plant of which it is composed, may be distinctly seen. It is frequently so tough and elastic, that the finest edge tool or spade can scarcely cut it. The water squeezed out of it generally effervesces with chalk, and when evaporated leaves little sediment.

When dug and dried it is a light coloured, porous substance; sometimes that colour is a dirty white, or bright yellow; seldom is it brown and never black. This genus is always specifically lighter than water, and it may be torn asunder easily; but it is so elastic when dry, that though it yields to compression for a time, it soon reverts to its former shape and size. When immersed in water, it absorbs that liquid readily, and becomes like a wet sponge. When burning it emits a light coloured smoke, little flame, and little heat—it does not last long and leaves a great deal of ashes.

These ashes are generally of a whitish grey colour; they seldom become red when exposed to the air. They are very light, contain few salts, and are scarcely attracted by the magnet.

M. Poiret describes another genus, which he calls compact moss; his description of it is sufficiently distinct. He says, "It is not found in shallow marshes, but in the bottom of canals and deep pools; it is not composed of similar plants with the former, but chiefly aquatics; these plants being mostly of a tender and pulpy texture, having neither coriaceous nor ligneous fibre, are more speedily decomposed than marshy plants; by this means they form a thick black pulp, which sinks to the bottom of the lake or pool. The moss which is thereby formed he calls compact, because, though soft and slimy when dug, yet by compression or when dried, it is at last converted into a solid, compact substance, which contains few, and sometimes no vegetables in their original organized form.

In its natural state, it is less elastic and much more compact and darker in colour than fibrous moss. It is more easily cut with an edge tool, and it contains few vegetables in a state of organization. It feels soft and pulpy to the touch; and the water squeezed out of it is of a deeper dye, and yields a more copious and inflammable sediment by evaporation.

When dug and dried, it is of a brownish black colour; and though soft at first, it soon becomes a solid, hard, tenacious substance, much more compact, much heavier and less elastic than fibrous peat. Though immersed in water, it will not absorb that liquid.

When burning it emits a darker smoke and brighter flame; it lasts much longer in the fire, and yields a more intense heat and more ashes.

Whether moss be intended for a soil or a manure, the above distinction may be of use; for it is obvious that these two genera must require very different treatment, in order to reduce them to either of these economical purposes.

It is a distinction, too, which has this obvious advantage, that the practical farmer can be at no loss to discriminate these two kinds. The difference that exists between them is so palpable as to be obvious at first sight.

If the above distinction be correct, we are at no loss to know of what materials each of the above genera is composed. The fibrous peat consists of a congeries of vegetable matter mostly in an organized state. The carbon contained in the fibres of these vegetables, has never yet been wholly dissolved; less soluble carbon therefore enters into the combination of this, than of compact peat—the former may therefore be expected to contain less bituminous matter, and on this account it must be less inflammable. But even in fibrous peat, a part of the carbon, especially that which is contained in the acids, oils, gums, and tannin, may have become soluble. By combining with the hydrogen of these vegetables, it must form an inflammable bituminous substance. The most fibrous peat on this account must be inflammable, and contain a small portion of oleaginous matter; and it is reasonable to suppose that by continual maceration, and the operation of those chemical agents which are found in moss, the whole fibrous structure of the vegetable may be ultimately destroyed, and the whole carbon it contains rendered soluble. By this means, the fibrous may at last be converted into compact moss.

This last therefore consists of the same elementary principles with the first; the chief difference between them is, that these elementary principles have all been separated and combined anew in compact peat, thereby forming a greater proportion of resinous, bituminous matter, such as has been detected in moss, surturbrandt, and the substance which accompanies it; whereas

only a part of these principles have been set free from their combinations in fibrous peat.

Highly bituminated peat is indeed a compact moss, and generally contains few or no vegetables in an organized state. It differs chiefly, if not solely, from the above genus, by the greater quantity of bituminous oil it contains; yet this one ingredient imprints on it such distinct characters that it is easy to discriminate the difference that exists between them. Bituminous is always black, like compact moss; but the former, when newly dug, feels softer and more greasy to the touch; it is, too, much more unfavourable to vegetation—no plant nor shrub will vegetate in it. The water squeezed out of it is of a darker colour, resembling that of tar melted; and when evaporated, it leaves a much greater sediment, and more inflammable.

When dried into peat, it becomes not only black, but glossy; it is of a resinous lustre in the fracture; when held in the hand it emits a fetid bituminous odour; and it is so ponderous, that it sinks in water.

When burning, it emits a bright white flame, like tallow or butter; it will even burn like cannel coal, when carried in the hand. When kindled, it is difficult to extinguish it—the smoke it yields is black and very dense—it leaves few ashes when burnt. If sulphuric acid be poured on it, the effervescence is so strong that it kindles into a flame, and discharges, by this means, as well as by distillation, a vast quantity of hydrogen, and carbonated hydrogen. The proportion of oil obtained from it, in the last process, is sometimes equal to one fifth or one third of its weight.

It is of much importance to consider this as constituting a distinct genus of moss; both because it is extremely unfavourble for cultivation as a soil, and because it is of much more value than any soil, for other economical purposes.

The consistency, colour, and chemical qualities of moss as a soil, sometimes depend on the mixture of other earths, and wherever this mixture takes place, such mosses ought to be classed under a distinct name, as they are possessed of different qualities from fibrous, compact, bituminous, or even calcarious moss.

Such as are mixed with a considerable proportion of clay and sand are of this description. Though in the eye of the chemist and natural historian, they cannot so well be considered as constituting a distinct genus, yet they unquestionably claim this dis-

tinction, when considered as a soil capable of improvement; for they require a different treatment from fibrous, compact, bituminous. or calcareous moss; and when improved, they constitute a different kind of soil. This distinction is of equal necessity, when moss is considered as capable of being converted into a manure for other soils; for this genus requires to be prepared in a manner totally different from any of the other genera, and the manure it yields is possessed of different qualities, and adapted to different soils.

The appropriate technical name of all moss is geanthrax: or coal of earth. Peat moss corresponds to this—properly speaking, the name peat ought only to be applied to dried moss—the single word moss ought to be applied to a piece of wet newly dug peat.

Some mosses contain in themselves, the best materials and the best manure for their improvement—they stand in no need of adventitious aid. Others are so absolutely sterile. that the expense of reclaiming them as a soil would surpass their value. To some, lime may be applied with great effect, others stand in need of no such manure; some may be pared and burnt to vast advantage, others would be utterly and for years, if not for ever, ruined as a soil by this practice—in some mosses, dung will operate immediately and long—applied to others, it will be of little or no use.

Some may serve as a soil, manure, or fuel. It is from want of due attention, and from the misapplication of manure and money, in cultivating different kinds of moss, by one and the same means, that so many have failed of success: hence the common cry against every attempt of this kind—hence the sarcasms and sneers of the vulgar—and hence, if the application of lime succeed in one moss, all adopt the same mode of culture, as if lime alone could succeed. And if dung succeed in another case, lime is condemned, and dung extolled as the only manure for every moss. Such failures, and such misapplication of labour, money, and manure, have done essential injury to the interests of agriculture. Every new case of this kind raises and redoubles the clamour; and the richer the proprietor, and the more he spends or throws away in the experiment, the louder the cry, and the stronger the prejudices of the public against such attempts become. Whereas, if we would follow nature, and mark her slow, silent and powerful hand, perpetually at work, and lend the feeble aid of art to her operations, success would be certain in every attempt.

In this essay some technical terms have unavoidably been used. As they may be unintelligible to some readers, the following vocabulary may be consulted.

Vocabulary.

1. *Oxygen* is one of the ingredients of the atmosphere, and a constituent principle of the acids, and many natural compounds. It has been called *vital* air, as it is absolutely requsite for the life of animals.

2. *Azote* is another ingredient of atmospheric air. The air consists of nearly seven parts of azote to two of oxygen. The former is as fatal to life, when alone, (hence its name) as the latter is favourable. But when both are combined in the proportion above named, they constitute the air we breathe.

3. *Hydrogen* as its name imports, is the basis of water. It is specifically much lighter than atmospheric air, and highly inflammable. Hence it was called inflammable air by the ancients. When it combines with oxygen it forms water; hence its name.

4. *Carbon* is the name given to the pure inflammable base of charcoal. It is seldom found pure. Generally it is combined with a little hydrogen and oxygen, and other foreign ingredients, derived from the substances from which charcoal is prepared.

5. *Carbonic acid* is a compound of carbon with oxygen. When pure, it exists in the form of gas. It was called fixed air by the old chemists, and is fatal to life when breathed.

6. *Phosphorus* is a substance highly inflammable. It exists in, and forms a constituent part of animal matter, and of several vegetables.

7. *Gallic acid* is found chiefly in those vegetables which have an astringent property; and it was once regarded as the principle of astringency. The quality, however, seems to arise more particularly from another vegetable principle, called *tanin*, as it operates chiefly in tanning leather. These two, the gallic acid and tanin, are often found to accompany each other.

8. *Pyrites* is a combination of metals with sulphur. With iron, sulphur forms iron pyrites. With copper, it forms copper pyrites. When exposed to moisture and air, they take fire. Hence the name *pyrites*, or, as it has been called, *fire-stone*.

9. *Sulphats* is the name applied to all the salts formed by the sulphuric acid. When iron is the base, it is called sulphat of

iron. So when copper, or potass, or ammonia form the base, it is called sulphat of copper, of potass, or of ammonia.

10. *Carbonates*, *muriats*, *&c.* are salts formed of the same bases, with carbonic, or muriatic acid.

11. *Surturbrandt* is a species of coal, which contains and seems chiefly to be composed of ligneous plants or trees, nearly in their original organic form.

12. *Bovey coal* is similar to surturbrandt.

HORN DISTEMPER IN CATTLE.

[Communicated by the President of the Society.]

In reading a Journal of Military Surgery lately published in France, by D. J. Larrey, M. D. first surgeon of the imperial guards, and inspector general of the medical staff of the French armies in Egypt, Italy, and Germany, I found an account written by him, of a contagious disease among the cattle in Italy, particularly in Venitian Frioul, in 1793, which almost destroyed the cattle in that quarter. He says, "the disease was at its acme when I arrived at Udino. It assumed all the characters of an inflammatory malignant fever. It commenced by a general heat, dryness of the nostrils, bristling of the hair, hardness of the skin and obstinate costiveness. The sick animal drooped its head—appeared agitated—the eyes became red and haggard. This fever proceeded from the commencement of the symptoms with more or less rapidity, according to the age of the animal or its irritability. After this first stage the abdomen became inflated; the hair dry and stiff; the strength failed; the ears became withered and pendant. Cutaneous perspiration ceased—respiration difficult—the animal tottered, and if it fell had not power to rise. Malignant tumors sometimes appeared on cows near the udder. I caused many of these animals to be opened and examined in my presence, and generally found the stomach filled with undigested herbs; the mucous membrane of the stomach and intestines inflamed and gangrened in many places, and the epiploons decayed. At the third stage the disease was highly contagious. All the cattle in the same enclosure with the infected animal took it and died. All other domestic animals took

the disease, particularly sheep. The dogs, cats, and even fowls were infected with it.

"The inhabitants of the places where it was most violent were subjected to its malignant influence. I first ordered the animal to be interred without taking off his skin. I then detailed the manner of treatment in the following terms. If the animal be robust at the commencement of the disease, he should be bled as soon as there are any appearances of inflammation, or the gums and pallate scarified, which is generally sufficient. Costiveness being one of the first symptoms of this disease, the rectum must be opened, which is best done with stimulating glysters. The hand would answer, but there is danger of taking the disease. Cooling drinks should be given, and the body sprinkled with warm vinegar and water, and covered with a woollen cloth. After employing these means, the horns of the animal should be bored in several places near the base. The instrument should be inserted deep enough to penetrate the cellular cavity, from which will issue the fluid that obstructs the frontal sinus. This operation has an influence on the brain and revives the animal. I ordered a hot iron to be passed through the thicker part of the dewlap, and inserted a roll of linen thread covered with basilicon, and, to promote irritation as the thread was moved, to have it sprinkled with powdered cantharides. If the animal is not materially altered for the better before the ninth day, I recommend killing him and burying him instantly to prevent contagion. As soon as the symptoms give way, light food, such as gruels from flour or barley meal, is the best.

"By following my prescriptions, in a few weeks the contagion and disease ceased completely, and I received the thanks of all the people and magistrates of that unhappy country. The preliminaries of peace having been agreed on with Austria, I was travelling to Trieste with my friend, General Desaix, through the Venetian territories."

AARON DEXTER.

THE disease described by the French surgeon appears to be the same, or nearly allied to what is called the *horn distemper* in this country.

Within a few years I have had two cases among my cattle. The first case I had ever seen was of a cow kept in my stable

in this town. The animal lost her appetite and milk suddenly, and was in a general tremor when I was first informed of any difficulty. A man from the country came into my barn, and on seeing the cow he pronounced her disorder to be the horn distemper, and that her horns were cold, but that he could cure her if I would permit him to pursue his own remedy. On obtaining my consent, he immediately bored a hole through each horn, within four inches of their base. He found them entirely hollow, a small quantity of bloody matter was discharged from the holes. He then gave her some medicine which I had prepared of senna and salts, which soon operated; after this he gave her gruel, seasoned with pepper, by means of a common glass bottle. In a few days the animal was well.

The second case was of a young ox at Chelsea the last June. I was informed by my farmer that one of my oxen was sick and would die. I went immediately to see him. The animal had been drooping several days and was unwilling to move; he would neither eat nor drink; and on the day I was informed of his sickness, after tottering some time he fell and lay stretched on the ground, in which position I found him; he seemed lifeless, except at intervals, when he made a moaning noise. His nostrils were dry, and his eyes sunk in their sockets. He appeared to have had no evacuations, but was very little swelled. His horns were bored through, within four inches of their base, from whence issued a small quantity of feted matter; they were hollow. He appeared insensible to the operation of boring. I poured into his horns some hot spirit mixed with pepper, which gave him some uneasiness and was soon followed by a discharge of mucous from the nose. A glyster of warm salt and water was given him. I directed some gruel of Indian meal, well seasoned with pepper, to be put into his stomach by the aid of a bottle, which operations were repeated several times in the course of the day. The next morning I saw him and found him better; the same applications were continued. On the fourth day, the animal raised himself with assistance on his feet and began to feed on the tender grass. He soon recovered, but was reduced almost to a skeleton. I believe the first symptoms of this disease, are loss of appetite and cold horns; with these appearances I should advise that the horns be immediately bored quite through with a nail gimblet, in preference to cutting them off as is frequently practised. A small stick or wire should be

passed through the horns every day to keep the hole from closing with gelatinous matter. If the disease does not change favourably the second day after boring the horns, I would advise that a sharp instrument be passed through the dewlap, and a roll of linen thread drawn through it, covered with turpentine, or basilicon if equally convenient, and when moved, as it should be every day, the thread should be sprinkled with powdered cantharides. This is Dr. Larrey's recommendation. I do not believe that any advantage is derived from having the perforating instrument heated, as it only tends to cauterize the parts and render the wound insensible to other stimulants.

With respect,

AARON DEXTER.

To the Trustees of the Massachusetts Society for Promoting Agriculture.

BOSTON, May 9th, 1815.

REMARKS ON THE CANKER WORM.

[To the Recording Secretary of the Massachusetts Society for Promoting Agriculture.]

Roxbury, May 22, 1815.

SIR,

AFTER having been freed for nearly twenty years from the ravages of the canker worm, by a providential frost on the 17th of May, 1794, our orchards are again overrun with them, and some of the most valuable trees of our country are threatened with destruction. It is true this evil can be prevented by another which, if we are not soon aided by a timely frost, may be deemed almost as great an one. The expense of tarring an orchard for several years, together with the injury sustained by the trees in the common mode of doing it, will be nearly equivalent to a total loss.

The improvements introduced by Mr. Parsons and other cultivators, of surrounding the trees with canvass and rope yarn, and stopping the descent of the tar by a bandage of coarse hemp together with the mixture of the tar with oil, so as to keep it longer in a soft state, have very much diminished the inconveniences of the old practice.

Still much remains to be desired. The process is imperfect, unless performed as faithfully in the fall as in the spring. If your neighbours are inattentive you may be subjected to this labour for ten or twenty years, and your orchards will scarcely pay the continued and accumulating expense.

Something further seems to be desirable, some mode more simple, less expensive, more effectual.

In the southern states, I perceive some persons are still ignorant of the natural history of this insect, and regret that it has not been examined and described by scientific men. We have nothing left to desire on this head. The description of the canker worm by Professor Peck is very satisfactory, and only leaves us to regret, that the same ingenuity could not have devised some speedy and simple mode of extirpating, or checking them.

Until some effectual mode is discovered, I think we should make constant experiments, and communicate fully the results, in the hope that if our trials shall not prove in every case successful, they may stimulate others to more happy ones.

I had understood that Mr. Josiah Knapp, of Boston, was induced to try the effect of air slacked lime. He put it round one of his trees in the spring of 1814, and I have been assured not only by him, but by another respectable friend who examined it, that it was fully successful. The tree was in a small garden, in Boston, surrounded with other trees which were filled with the worms, and this one wholly escaped, except that a few appeared to have attacked its extremities, where they were interlocked with the other trees.

I mentioned this fact to a Rhode Island gentleman, who informed me, that in that State they had used the rubbish collected from the breaking of flax, and it had effectually prevented the rise of the insect.

I resolved to make the experiment of lime on an extensive scale. As the insects rise in the fall, I determined to put the lime on in the autumn.

For this purpose I had the turf dug in around sixty apple trees, and the earth laid smooth. I then took three hogsheads of *effete* or air slacked lime, and strewed it an inch thick round my trees, to the extent of about two or three feet from the roots, so that the whole diameter of the opening was from four to six feet.

I tarred these tress as well as the others, and although I had worms or grubs on most that were not limed, I did not catch a single grub where the trees were limed.

I do not mean to speak with confidence. I am however strongly encouraged to believe the remedy perfect. It was ascertained by Professor Peck, that the insect seldom descended into the ground at a greater distance than three or four feet from the trunk, and to the depth of four inches, or that the greater part come within that distance. The lime is known to be destructive of all animal substances, and I have little doubt that it actually decomposes and destroys the insect in the chrysalis state, at least, I hope this is the case.

There are many reasons which should encourage the repetition of this experiment. The digging round the trees is highly useful to them, while tarring is very injurious. The expense is not great. A man can dig round fifty large trees in one day. The lime is a most salutary manure to the trees. After the spot has been once opened and limed, the labour of keeping it open will not be great. Three hoghsheads of air slacked lime, or sweepings of a lime store, will suffice for fifty trees, and will cost three dollars. As it is done but once a year, I think it cannot be half so expensive as tarring.

I repeat it, sir, that I mention my experiments with great diffidence, as being the first of my own knowledge. It may induce several persons to try it in different places, and where trees are surrounded with others which are treated differently. All I pray is, that it may prove to be successful and relieve us from this dreadful scourge which defaces our country, while it impoverishes and disappoints the farmer. If it should succeed, Mr Knapp will merit the thanks of the public for his ingenious experiment.

J. LOWELL.

ON THE RELATIVE ADVANTAGES OF FEEDING CATTLE IN THE STABLE OR FARM YARD, OR SENDING THEM TO PASTURES.

This is one of the questions which have been much discussed in Europe of late years. Perhaps it is one, which can only arise in countries which have arrived at a pretty high degree of im-

provement in agriculture. Perhaps it can only be of interest where the population bears a greater proportion to the land which supports it than it does in New England.

While our farms are so extensive, and while our cultivators continue poor and unable to till the whole of their lands, perhaps it may be more profitable to continue to let our cattle roam over uncultivated fields, gathering a scanty subsistence, or fattening themselves on extensive tracts, which the farmer can neither beneficially cultivate nor advantageously sell.

But since the state of Massachusetts, to which our labours are chiefly confined, and our views in the first instance directed, has in many parts arrived to a higher degree of improvement; since near the great towns, and in the counties of Essex, Hampshire, and Worcester, lands have appreciated in value, and farms have become more divided, it may not be too early to begin the discussion of this question, which has been received and discussed with so much interest in Europe.

It is now almost received as established truth in England, that it is more profitable to feed cattle in the barn yard from green fodder cut for them, than to permit them to roam over and tread down, and destroy the grass of many acres, in which the very abundance creates satiety and disgust to the herd which feed upon them.

In France the doctrine was received more recently, but not with less favor, by the intelligent cultivators, and it would seem that Europe owes to the Swiss, who are very economical farmers, the introduction of the practice.

For the amusement and instruction of your readers, I shall make an abstract of some remarks of the Abbe Rosier on this subject.

One of the Trustees of the Massachusetts Agricultural Society.

Roxbury, May 22d, 1815.

"We owe to Monsieur Ischeffeli, of Berne, a train of remarks and experiments on this subject, as judicious as they are important, which have begun to produce a revolution on this subject in Switzerland, where they raise a prodigious number of cattle. May the example he has afforded be imitated in France!

"The immediate and direct profit of horned cattle consists—1st, In their multiplication 2d, In their sale when fatted. 3d, In their milk. 4th, In their labour.

"All these advantages depend on the health of the cattle, and this health is the result—1st, Of well chosen, sufficient and regulated nourishment. 2d, Of the care taken of the animal. 3d, Of the repose you allow to them. 4th, Of the salubrity or goodness of the water they drink. 5th, Of the temperature of the air to which they are exposed.

"Many of our farmers have too many cattle for their winter supply of provender. They are obliged to turn them out early. These hungry animals find the pastures almost destitute of proper food. Rain, frost, winds, to which they are exposed, often occasion serious diseases among them or check their growth. Even the summer itself brings with it afflictions to cattle which are in pasture. They are attacked by flies and a thousand other insects which harass them. Often exhausted and thirsty, they run to quench their thirst into some stagnant and unhealthy pool, which is the occasion of many serious maladies.

"In autumn they are not exempt from evils. The weather is often wet and cold, and the beasts are exposed to changes and vicissitudes which are pernicious to them.

"The promiscuous connection of cattle in large pastures is also injurious, as it tends to degrade and injure the breed.

"Young cattle are suffered to run with the old, and heifers of one or two years old are often impregnated, by which means they are stinted in their growth, and produce a feeble and degenerate race.

"To this system of Monsieur Ischeffeli, of feeding the cattle in the yard, objections of various kinds have been made.

"First. It is said that the health of the cattle requires that they should be put into pastures where they may roam freely, because it is the natural condition of such animals. We agree that in mild climates, of which these animals were probably natives, this would be true; such for example, as Mexico and part of South America; but whatever may have been the cause, whether the manner in which we have treated them, or any other cause, it is a fact that they are now so tender, that even in the mild climate of France they require shelter in winter, and being so sheltered, they require even in spring and autumn some protection against the inclemencies of the weather. It is also true,

that epidemic diseases have most usually taken their rise among cattle which have been pastured in large droves, and they certainly are more easily communicated there.

"In the famous epidemic which destroyed nearly all the cattle of Languedock, and of the west of France, in 1775, 1776, and 1777, when the disease was so dreadful, that its propagation was stopped only by a cordon or line of troops, it is well known, that a single ox from Hungary brought the disease into Italy, and destroyed the cattle of that country, and that both there and in France, those who kept their cattle shut up in their stables or barns escaped the calamity.

"The second objection to feeding cattle in the yard is, that it absorbs all the profit. This is an idle and unfounded objection. If the animals eat more in the yard, if they enjoy better health, if the cows give more milk, what can we answer? This is what we shall prove. The great benefit of the mode we recommend is the increase of manure. This is the great support of every farm, and the most important object of every cultivator.

"It is well known, that in Switzerland they esteem four acres but a moderate quantity of pasturage for one good cow, from the 10th of May to the 15th of October. This quantity of land would much more than suffice if the fodder was cut green and carried to the animal. It is incredible what a quantity of food is trodden down and destroyed by cattle in pastures, into which they are turned. Those who have tried this mode in France of feeding cattle on green fodder cut for them have found, that four cows may be fed on the grass of an equal sized piece of poor land, when a like quantity of excellent land would not keep three in the common mode of pasturing. The difference between the consumption of a cow of green fodder and of hay is amazing. It is well ascertained, that a cow will consume one hundred and fifty weight of grass, say clover, per day, whereas in winter she will only eat twenty-five pounds of hay per day. This difference of consumption you perceive in the increased quantity of manure; and it is also well ascertained, that the quality of the manure is much better from the animals in summer, than in winter.

"It is also still more true as to the food. The most subtle and nutritious particles escape in drying the grass. Hence the exquisite flavour exhaled by grass in the process of making the hay, all which is lost to the animal.

"It is a well attested and indisputable fact, that cattle fatted for the market are sooner and better fatted, cows give much more milk, and young cattle thrive much more when fed in the stable from green fodder, than when pastured.

"We should conclude from our observations, that every intelligent farmer who understands his interest will make no more hay than is necessary for winter, but that he will feed his cattle from his mowing lands daily with fresh cut grass. Thus he will accumulate much more manure, his cattle will be better fed and at less expense of food."—ABBE ROSIER.

SERIES OF EXPERIMENTS TO ASCERTAIN THE QUANTITY OF SEED NECESSARY TO PRODUCE THE BEST CROP OF POTATOES.

[To the Corresponding Secretary.]

SIR, *Dover, N. H. April 8th*, 1815.

IN a climate so far north as ours, especially New Hampshire and the District of Maine, where our crops of Indian corn are liable to be cut off, or much injured by vernal and autumnal frosts, and when on this crop it is that the great mass of the population depend for their bread, it becomes a desideratum to cultivate in plenty some vegetable which is more certain in its produce, and at the same time the best substitute for Indian corn.

The potatoe being of easy cultivation, generally abundant in its produce, and of quick growth—ripening in three or four months—and being allowed by all to be the best substitute for bread—its cultivation should therefore attract the serious attention of farmers.

Should there be a very abundant crop and no market for them, they will richly repay the farmer his expense and trouble in raising, for the purpose of feeding his sheep, swine, and cattle.

The cold, wet summer of 1812, and severe frosts, destroyed in a great measure the Indian corn in this section of the country; and, in the interior, many, who in common seasons had produce to spare for the market, suffered severely for want of provisions, both vegetable and animal; the scarcity of the one producing in

a degree that of the other. Had large crops of potatoes been raised, this evil would have been obviated in a great measure.

So wide a difference of opinion exists amongst both scientific and merely practical farmers, as to the quantity of seed necessary to produce the best crop of potatoes, I had determined to make an experiment on this subject. For this purpose I selected a piece of sandy loam incumbent on a substratum of sand, the whole ground as near alike, as to quality, as possible; and now enclose you the result of forty experiments.

Should you think the enclosed paper worthy the notice of your very valuable and respectable Society, or of publication, please to dispose of it as you think proper, but without my name.

These experiments were made under my immediate inspection, therefore I can answer for their correctness.

I am, Sir, &c.

Result of fifteen Experiments, made at Dover, (N. H.) A. D. 1813, *of seeding Potatoes, consisting of* 20 *hills—the rows* 3 *feet apart, hills* 2 *feet,* without any manure, *on sandy loam that had been two years planted.*

Number of experiments.	*Quantity of seed.* oz.	*Description of the seed as put into the ground.*	*wt of seed in 20 hills.* lbs	oz	*Total produce.*
No. 1	12	Two whole potatoes, - - -	15		80
2	6	One do. - - - - -	7	8	48
3	12	Two do. cut in halves, latitudinally,	15		61
4	6	One do. do. do.	7	8	55
5	2	The eyes of 2 potatoes, which weighed 12oz.	3	4	28
6	1	The eyes of 1 do. do.	1	10	20
7	6	One potatoe cut in quarters, longitudinally,	7	8	56
8	3	Half do. do. do.	3	12	35
9	3	Half do. cut in halves, do.	3	12	37
10	1½	One quarter of a potatoe, - -	1	14	32
11	4	Four potatoes, whole, wt. 1oz. each, produce small size,	5		39
12	2	Two do. do. do. rather small,	2	8	35
13	1	One do. do. do. good size,	1	4	31
14	4	The sprout end of 2 potatoes, ⅓ of each,	5		42
15	6	One potatoe, weight 6oz. eyes cut out,	7	8	33
			88	0	632
		Gain by manuring, - -			143
					lbs. 775

The following fifteen Experiments are exactly the same as the former, with the addition only of a shovel full of good barn manure to each hill.

Number of experiments	Quantity of seed oz	Description of the seed as put into the ground.	wt of seed in 20 hills lbs	wt of seed in 20 hills oz.	Total produce.
No. 1	12	Two whole potatoes, - - -	15		76
2	6	One do. - - - -	7	8	46
3	12	Two do. cut in halves, latitudinally,	15		73
4	6	One do. do. do.	7	8	64
5	2	The eyes of 2 potatoes, which weighed 12oz.	3	4	44
6	1	The eyes of 1 do. do.	1	10	46
7	6	One potatoe cut in quarters, longitudinally,	7	8	65
8	3	Half do. do. do.	3	12	48
9	3	Half do. cut in halves, do.	3	12	54
10	1½	One quarter of a potatoe, - - -	1	14	38
11	4	Four potatoes, wt. 1oz. each, the produce small size,	5		52
12	2	Two do. do. rather small,	2	8	44
13	1	One do. do. good size,	1	4	37
14	4	The sprout end of 2 potatoes, ⅓ of each,	5		46
15	6	One potatoe, the eyes cut out, - -	7	8	42
			88	0	775

*Result of ten experiments of seeding Potatoes, 20 hills each, manured with a small hand-full of *Rock-weed.*

Number of experiments.	Quantity of seed. oz	Description of the seed as put into the ground.	wt. of seed in 20 hills. lbs	wt. of seed in 20 hills. oz	Total produce.
No. 1	12	Two whole potatoes, - - -	15		73
2	6	One do. - - - -	7	8	61
3	6	One do. quartered longitudinally,	7	8	67
4	3	One half potatoe, divided do.	3	12	52
5	1½	One quarter of the potatoe, - -	1	14	26
6	8	Four whole potatoes, 2 oz. each, - -	10		69
7	6	Three do. do. - -	7	8	44
8	4	Two do. do. - - -	5		58
9	2	One do. do. - -	2	8	42
10	2	One do. cut in halves, - -	2	8	47
			63	2	534

* Fucus of Lin. much used as a manure for raising corn on sandy plains in this vicinity.

The foregoing experiments prove, what all experienced farmers were convinced of, that poor land requires more seed in all kinds of crops, than that under a high state of cultivation.

N. B. A bushel of potatoes weighs 56 to 58 lbs.

The potatoe used for seed in the above described experiments was the large blue.

DISORDER AMONG SHEEP.

[From the Herald of Liberty.—Kennebec County.]

THERE is a disorder prevailing among sheep, which is, I believe, little known, yet very destructive. My object in communicating the facts, of which I am by accident in possession, is to induce some gentleman, who is learned on the subject, to show the cause and point out the remedy.

In the month of December a number of my three quarters blooded Merino bucks were taken with scouring. I immediately used such remedies, as appeared to me to be indicated; among which was a strong decoction of white pine bark, of white oak bark, and many other things, not important to be mentioned. The disorder baffled all my exertions, and they died in the course of five or six weeks. A number of my half blooded wethers were also seized with the same distemper. Instead of giving them astringents, I gave them salts and castor oil; but without any benefit. I continued to try experiments upon them for a long time without sucsess, and therefore concluded that the disease was incurable, and made no further exertions, not suspecting the real cause of their death, of which I should forever have remained ignorant, had not an accident revealed it to me. As I was moving one of them by the horn while alive, the horn came off, and to my astonishment it was almost full of worms of a brownish colour, with five or six black stripes across the back. Many of them were near an inch in length, and more than a third of an inch in diameter. On examining the head I found some large and some small ones. The smallest were not larger than a cheese-maggot and as white as chalk, while others were as large as before described. I afterwards examined those that had previously died, and found the same kind of worms in their heads. As all that had died were males, they all had horns, the pith of which

was almost entirely devoured, as well as much substance in the forehead. I desired a number of my neighbors to examine their sheep, which had died, (some by scouring and some otherwise) they accordingly did and found worms in the head I believe there were more than a hundred worms in the head which was eaten as hollow as a pumpkin. I tried only two experiments upon them after I found the cause of death. I cut off the wool from the forehead of one wether, and washed the skin with the Spirits of Turpentine, in which I also wet a cloth and bound it upon his head. I repeated the application a number of times, and I found it made it worse I caused it to be killed in order to know whether the worms were dead, but I found they were all alive. I then tried another experiment on an ewe. I took my tobacco pipe, with which I smoke my sheep, and put the tube into one nostril, and blowed up tobacco-smoke into the head with so much force, that it came out at the other nostril, and brought out one dead worm. The experiment was repeated a number of times; but the effect on the sheep was more powerful than on the worms. When it was acertained that the sheep must soon die, it was thought best to kill it, in order, as in the other case, to see the state of the worms. (as they live but a short time after the death of the sheep) and they were as lively as if nothing had been done. All which I have lost, had worms, but all have not scoured. Those which have died this spring were not seized with scouring. They had no visible disorder upon them. One not acquainted would suppose they died for want of food. The symptoms, other than scouring, are dulness of eyes—partial loss of appetite—shaking of the head—when they lie down they rest their head on the ground Some live a number of months after they begin to pine; and I have even known some to live many days after they are so weak that they cannot stand, and for two or three days, when they exhibit no other sign of life than of breathing, lying perfectly motionless.

An opinion has been advanced, that this disease has been introduced by the Merino breed, which ought therefore to be killed or banished from the country. before they communicate incurable and fatal diseases to our own native sheep. I am, however, in possession of evidence, which to my mind is conclusive, that this opinion is wholly unfounded. It is true, that I have lost but one native sheep; it is as true, that I have lost but one, that was more than one year old; and it is also true that I have none of

the native breed less than two years old ; and this disorder has not attacked any of my flock, but last spring lambs, except one native sheep somewhat in years. It does not therefore, appear that the merino or mixed breed are more subject to this fatal disorder than native sheep of the same class. I have still farther evidence on this point. The native ewe which I lost was purchased more than a year ago from a flock, among which a merino had never been. She died a few days since, having but few worms and those very large. From appearance, I have no doubt that she had worms before I bought her; her symptoms at that time I think warrant the conclusion. A number of years ago, before the merinos were introduced into the country, I lost five or six wethers of one year old, all I had of that age ; they died in the same way as those I lost lately. There is not a doubt in my mind, that worms in the head were the cause of their death. I have heard of a great number of sheep that have died in the District of Maine, of scouring, the winter past. Some gentlemen are of opinion that it is the same disorder that appeared among sheep many years ago under the name of rot. If it be the same disease, the merinos are clear from the imputation of having introduced the disease into the country.

I have seen no author, who treats of worms in the head, except Livingston. He says, "I lost an ewe one year old. She appeared bewildered and turned herself often, staggered, and pined away gradually. At the end of eight days from the time I observed her complaint, she died, very much extenuated, although kept in a piece of luscious grass. On opening her head I found the brain mortified, and extracted three white worms of about half an inch in length. I know no remedy." These could not have been the same kind of worms that I have observed. The symptoms were different, and I have in no instance seen the brain mortified. The worms were not upon the brain, but in the frontal sinuses (as medical gentlemen say) which are cavities between the two layers of the bone that makes the forehead.

Several of the last victims were ewes of the mixed breed one year old. A number more in my flock now show symptoms of the disease, none of which are more than two years old ; and I am not without apprehension that a great portion of my flock will fall a prey to this dreadful malady.

I shall make no comments upon the subject. I have stated the facts as nearly as I can. I think, however, that this disease is more to be feared than any that has attacked that useful animal since they were imported into this country.

It has been suggested that the worms are conveyed into the head by a bee, bug, or fly, leaving its eggs in the nostrils of the sheep. If such be the fact, how is it that we find some worms apparently but a few days old, and others, for aught that appears, several months old? Why are males more subject to the disease than females, and young sheep than old ones? These are queries which I am unable to answer.

Vassalborough, April 20, 1815.

EXPERIMENTS ON THE CULTURE OF POTATOES.

BY SAMUEL G. PERKINS, ESQ.

[To the Hon. Josiah Quincy, Esq.]

Boston, April 4th, 1815.

DEAR SIR,

AGREEABLY to your request, I have committed to writing the facts in relation to three potatoes, weighing eighteen ounces, which I planted the 27th of April, 1813. These potatoes were cut into ninety-four *sets*, each *set* containing one, two or three eyes, and were planted in two drills, each thirty-nine feet long, one half about fifteen inches, and the other half about seven inches distant from each other; the rows or drills were two and an half feet apart. The ground was good and the soil deep, but I put no manure upon it that season.

On the seventh of October, I caused the potatoes to be taken out of the ground and measured in my presence, heaping them as long as they would lay one on the other, and I found there were about four and an half bushels. With a view, however, to ascertain the precise increase, I weighed the whole parcel after separating those which were too small for the table, and found I had 255 pounds of large handsome potatoes fit for table use, and eighteen pounds of small ones fit only for cattle, making an aggregate of 273 pounds from one pound and two ounces of

seed, or 242 pounds for one. This would give upwards of 3140 bushels for every thirteen bushels of seed employed, which is about the average quantity planted on an acre of ground; but this, I conceive, is not the proper mode of estimating the advantages to be derived from planting these potatoes* in the manner adopted by me. There is, to be sure, a great saving of seed, which is of some importance to the farmer who raises potatoes in large quantities for cattle or for distillation; it will be seen, however, more in the ground employed, which was about ninety-seven square feet, or the 264th part of an acre, which last number, multiplied by $4\frac{1}{2}$, (the number of bushels raised on the ninety-seven feet of ground,) gives 1180 bushels to the acre; or if estimated at sixty pounds the bushel, is a little over 1200 bushels to the acre. This product, taken in conjunction with the saving of seed, may be of importance to the farmer.

I have before observed that one half the *sets* were placed about fifteen inches apart, and the other half were only seven inches distant. This I did with a view to ascertain whether those that were nearest together, would produce as abundantly as those which had more room to extend themselves, and I found, as I expected, that the *sets* which were planted farthest apart, produced much more abundantly than the others. Had the season been a good one for the raising of potatoes, and the *sets* been placed at eighteen inches asunder in the drills, I have no doubt I should have had at least six bushels from my three potatoes.

The experiment which I made last year with straw, as a manure for potatoes, I have not communicated to the Society, because it was not made with sufficient precision to establish the accurate advantage of the dry over the wet manure. As you have urged me to state the facts to you as they are, I have subjoined them. Last spring I caused two drills to be made in my garden of equal length, and three feet distant from each other in rather poor ground. At the bottom of one of these drills or furrows I placed some rotten hot-bed horse manure, on which I placed the *sets* of some potatoes which I had prepared, and levelled the ground over them. At the bottom of the other furrow I placed some straw which had served to cover my Strawberry

* These potatoes were given me by Mr. Tyng; they were white and full of eyes.

Vines, Carnations, &c. during the winter. This I covered over with a little earth, and planted the potatoe *sets* on it at the same distance, one from the other, which had been observed in the other trench. I then levelled the earth over them, and put stakes, which I marked, at the end of each row. My gardener, (a Scotchman) asked me what object I had in view, and when I told him it was to ascertain which manure would produce the largest crop, he appeared surprised that I should doubt. Finding me serious, however, he said I should see that the potatoes in the row with hot bed manure would be double in quantity and size over the others. When the vines first showed themselves, and for a month or six weeks afterwards, the row which the gardener had adopted as *his*, was much more vigorous than the one he pleased to call mine; and whenever I went to that part of the garden, he called my attention to the difference in the strength and growth of the vines in the two rows. His were, to be sure, much the finest; but as the dry manure began to decompose, my vines began to start, and every day gave me new occasion, in my turn, to call the attention of the gardener to the increase of the potatoe tops in my row, and the extreme vigour and length which they were constantly acquiring. This he saw with astonishment, if not with regret, until they were double the size and length of the others. From the great increase of vines in my row, I expected double the quantity of potatoes; but here I was mistaken and disappointed. My gardener, who took up the roots from the two rows under my eye, thought there were only a quarter part more in quantity; but he acknowledged they were much finer in appearance and size than those from the hot-bed manure. I did not weigh nor measure them, as I was at that time out of health and could not attend to the business myself. I am satisfied, however, from the experiment, that dry or undecomposed manures are much more efficacious and useful in many cases than those which have been rotted above ground, and thus lost, by evaporation, the greater portion of their strength.

It must be confessed that the great increase from so small a quantity of seed, as was planted in the instance first mentioned, cannot be expected in field culture. The soil is neither so deep nor so loose as in a garden constantly worked over with the spade, and of course the fibrous roots cannot extend themselves with so much facility; but, I believe great improvements may

be made in field cultivation as well as in gardens. When the soil is pretty deep and well broken up, great saving in the labour which is now bestowed in hilling potatoes, might be made. When the ground is hoed to destroy the weeds, a little earth drawn to the vines to protect the roots from drought will be better than to heap on loads of earth as is the custom among us. All that is necessary, in my opinion, is to keep the ground clear of weeds. I have practised this mode with success. If the preceding facts can be of any use to you, or if they will contribute to make 150 bushels of potatoes grow where 100 only grew before, I shall be amply paid for the time I have bestowed on the subject.

With regard to the experiment of the manure, I am of opinion that it will be best to try them once or twice upon a small scale before you attempt the planting of large parcels, that there may be no waste of seed, labour, or time, which would be considerable should it fail when tried upon a large scale.

Your obedient, humble servant,

SAMUEL G. PERKINS.

CROPS OF WHEAT RAISED IN DANVERS, COUNTY OF ESSEX, IN THE YEAR 1814.

[To the Corresponding Secretary.]

SIR, *Danvers, April 13th*, 1815.

AGREEABLE to a request of the Massachusetts Agricultural Society, published in the newspapers, I transmit you an account of wheat raised the last season in this town. I believe there was but one kind of wheat sown—the summer-bearded wheat, (Londonderry wheat.) It was sown on various kinds of land, differently managed, manured, and the products accordingly various. The greatest crop was raised on a sandy plain, highly manured, viz.: one bushel, sown on three quarters of an acre, produced twenty bushels. In this town there were sown twenty-nine and an half bushels, on twenty-four and an half acres of land—produce *two hundred and eighty-three bushels*. We are desirous of obtaining some of the seed of the Sea-Kale,

Woad, Madder, and the Fiorin Grass (*Agrostis procumbens*); could you furnish us with either, or inform us how to obtain them, you would much oblige the Danvers Agricultural Society.

Yours, &c.

ANDREW NICHOLS,
Corresponding Secretary.

WHEAT CROPS RAISED IN ANDOVER, IN 1814, WITH REMARKS ON THE CULTURE OF FLAX.

BY GEORGE OSGOOD, ESQ.

[To the Recording Secretary.]

DEAR SIR, *Andover, 14th January*, 1815.

A REQUEST having been made for information on the culture of wheat, I beg leave to communicate the successful experiments in this vicinity. Till within a few years farmers were discouraged from cultivating this valuable grain, from the uncertainty of the crop—wheat being more liable to blight than other small grains.

For sixteen years past I have sowed wheat, when I had in tillage suitable land, and have generally had twenty bushels from an acre. The land most suitable, in my estimation, for the cultivation of wheat, is land favourable for early vegetation. The old aphorism, "sow wheat in the fire," is, with some limitation, true; but what farmers call warm land, with a lively deep soil, is favourable to an abundant crop. It is of importance that spring wheat be sowed early in the spring. The quantity of seed for an acre is varied from five pecks to two bushels; six pecks to the acre, I believe, is the general practice in this town—lands weedy and of a deep rich soil require more. The seed is prepared by mixing with it fine ashes, and sprinkling it with water, daily stirring it, till the grain is enlarged.

Within a few years has been introduced a new species of wheat, called white wheat, and its never having blighted, has induced farmers generally to cultivate it; more wheat has been raised within two years past, than for twenty years before. A variety of soils have received it, and the average crops have been

twenty bushels from an acre. It has not only been exempt from blight, but the wheat has yielded a whiter flour, than the wheat heretofore cultivated. Forty pounds of good fine flour have been received from one bushel, after the usual deduction of toll for grinding and bolting. Such has been the encouragement, from abundant crops, the goodness of grain and its high price, that lands heretofore appropriated to the culture of rye, oats and barley, have been sown with wheat. How long we may be encouraged in the cultivation of this pleasant and useful grain, is uncertain. The experiments many years since, in the Siberian wheat, gave equal encouragement; but it soon became assimilated to our climate and soil, and was more subject to blight than our common wheat.

Having read the observations of Mr. Hallet and Mr. Morse upon the cultivation of flax, (although unsolicited,) I would make a few observations upon the culture of this useful plant, which I do, as a practical farmer. I shall not engage in controversy, but simply state reasons and facts.

I consider the two great enemies to flax are weeds and worms, which are abundant in our old cultivated fields, and therefore the crops are very uncertain in such lands. Most farmers have pasture lands, that need ploughing, either from the abounding of bushes, or from the hardness of the sward, or, as farmers say, "the land is bound out." Such land, if not too moist, sandy, or gravelly, when subdued by tillage, I found, by repeated experiments, is the most favourable to the cultivation of flax, and is seldom annoyed by the forementioned enemies. It is an encouragement to cultivate such land, were it only for a flax crop; but the judicious farmer will be anxious to cultivate such land from other motives. The manner of preparing the ground for flax is of some importance. Shallow ploughing, and much harrowing to pulverize the surface of the ground for the reception of the seed, I have found favorable to an abundant crop. Flax has short roots, but it requires a soft, fine bed, and vegetation should not be impeded by a cloddy surface.

The time of sowing flax is of considerable importance. If sowed in May or June, the vegetation will be too rapid; and although you may have a great crop of stalks, the proportion of flax will be small. It has been said by old farmers, that March *tow* is better than May *tier*—(the last term is flax from the hatchel.) It is observed of those trees which are of hasty growth, that the bark is thin, and vice versa. The bark of the flax plant

is what we call flax; and if we may be allowed to reason from analogy, the coat of the flax stalk will be thicker when of slow growth. The middle of April I have considered the proper season for sowing flax; but it must depend upon the early or late advance of the season—some years it may be sowed earlier, and other years later. There have been various opinions respecting the seeding of the ground. The common practice in this vicinity, was sowing two bushels of seed to an acre; but a few sowed less, and some only one bushel. From observing the variety of experiments, I sowed five pecks of seed on an acre—my crop was four hundred pounds of well dressed flax, and eight bushels of seed. Some who have sowed one bushel, have raised six hundred pounds, and an increased proportion of seed. As I have for several years been ploughing my bushy pastures, I have yearly sowed with flax from one to two acres, with nearly equal success.

There are several important reasons for thin seeding. The plants are not so apt to lodge, and the seed is better and more; and when commerce was free the seed was of considerable importance.

When my pasture lands are properly tilled, I wish to sow in grass seed, and if the flax stalks are thick, they destroy the young plants; but in the manner I sow, the subsequent crop of grass is as great as from sowing grass seed with rye or oats. But one very important reason is the facility with which large stalks are dressed. A man skilled in swingling will swingle from forty to sixty pounds a day, in the month of March; whereas, the same man would not swingle more than fifteen pounds from the flax of fine stalks.

It may be objected that coarse flax will not make fine yarn. But what are the most profitable manufactures in New-England in a time of peace? Are not coarse cloths? Such flax is suited to the common manufactures of the farmer, shoe maker, harness maker, and sail maker. From such flax I have had made cloth seventy knots to the yard, and finer is not profitable where labour is as in this country.

Much attention is requisite in the bleaching of flax; and neglects here, have often nearly destroyed a good crop. Many farmers delay spreading their flax, till frosts; and many who spread early, suffer it to lie too long on the ground. The careful farmer, will watchfully attend to the seasons and the bleaching.

GEORGE OSGOOD.

MEMORANDUM OF THE QUANTITY OF WHEAT RAISED IN NEWBURY, THIRD PARISH, IN 1814.

[Communicated by John Osgood, Esq.]

In the third parish of Newbury, the wheat sown was one hundred and seventy-eight bushels on eighty-nine acres. Produce from the above, one thousand nine hundred and fifty-six bushels.

JOHN OSGOOD.

December 1814.

ON OIL AS A MANURE.

BY C. BALDWIN, ESQ.

[From Hunter's Georgical Essays.]

Having for many years considered oil as the great pabulum of plants, I was much disappointed at the result of some experiments, from which it would seem that oil was a poison; and turning the subject frequently in mind, it at last occurred to me, that though oil in a crude state might act as a poison, it might be so changed as to convey it with great advantage to the soil, and I instantly recollected Dr. Hunter's mode by ashes; it also occurred to me, that rape oil cake was known to be an excellent manure, that no objection had ever been made to it but its expensiveness, and that if it was beneficial to the soil, it could only be so from the quantity of oil contained in it, though that quantity must be very small indeed, considering the process of first grinding the rape seed, and the rash force used to drive out the oil, so that what remains is little more than a *caput mortuum*; yet the cake formed of these very remains is known to be a rich manure.

Think for a moment from how many seeds, plants, shrubs, and trees, we draw oil; from rape seed, linseed, mustard, fennel, aniseed, juniper, caraways, mint, olives, &c. Thus we evidently draw an immense quantity of oil from the earth, but how and when do we convey any to it? I know of little or no attention paid to this circumstance in our compost dunghills, so that all the oil conveyed to them can only be from animal dung.

Whatever may be the quantity of oil remaining in each rapé cake, (and I believe that no one will state it at half an ounce each,) yet it must be remembered that after all it is only a *vegetable* oil; reflecting on this circumstance, and fully persuaded that *animal* oil must be superior to it, I directly went to town to inquire the price of whale or train oil, and there I was informed, that it was about two shillings and eight pence per gallon, this I considered as too expensive; but pursuing my object, I was informed by Mr. Wilfred Read, oil merchant, that he could supply me with bottoms or foots of oil, and a rich, thick South Sea whale oil, at fourteen pence per gallon. This was the very thing I wished for, and directly ordered sixty gallons for a five acre field, and thus went to work. Having a platform or bottom of twenty loads of mould with eight loads of dung on it, I carried on three loads of light sandy mould, and one load of brick and mortar rubbish ground fine, and having mixed these well, and made a kind of dish of it, about five feet wide and ten feet long, with a ladle we put over it one half of the oil. It was in August, and the heat of the sun soon made the thick oil soak into this compost, when it was directly thrown up in a heap, broke down again, and by five or six turnings well mixed together, and left in a heap two days, when it was spread equally over the whole dunghill; twenty loads more of good mould were then carried on, eight loads of dung, and the remaining thirty gallons of oil were mixed as before, in sandy mould and brick and mortar rubbish, and equally spread over, and the whole was covered by trimming the four sides of the dung hill and throwing it on the top.

Thus the dung hill lay more than two months, when it was cut down by mattocks, carefully broke, well mixed and turned over. The end of March, it was carried on the fields, spread and ploughed in; it lay about a fortnight, was then ploughed again, and on the 22d of April last, it was drilled with the Rev. Mr. Cooke's most excellent drill; I mean his last, with hoes and scarifiers, which I think much superior to his former one: the last, I think every farmer who has seen it at work will consider it as incapable of further improvement. The field was drilled with barley, two bushels to the acre; the crop came up in a most even and beautiful manner; every seed was up within forty hours of each other; all were ripe at the same time, and, from a

couple of months after seed time to harvest, was rated by all who saw it, and it was seen by many, as a sixty bushel crop.

At harvest, three rows were cut across the field, directly threshed and measured; one load out of thirteen was also threshed and measured, and both stated the crop to be sixty bushels. But to wave all possibility of doubt or dispute, I am contented to state the crop at seven quarters per acre.

As to the quality of the barley, I could here cite the opinion of one of the most eminent brewers in London, who saw the crop growing, and declared he would readily give £1000 to be assured that all the barley crops in the kingdom were of equal burden and weight; five quarters of it have lately been sent to Nathrapps, in Norfolk, as seed barley, under the denomination of fifteen comb barley, weighing fifty five pounds per bushel of Winchester measure.

It is well known that all animal substances, in a state of corruption, wonderfully promote vegetation, and are the actual food of plants.

Whether I used oil enough, or what is the proper quantity, experience must decide. Say I used twelve gallons of oil to eight loads of mould and four loads of dung per acre.

That oil applied to land as a food for plants, in its crude state, acts as a poison, I cannot deny; but my process is very different; I believe that oil, particularly animal oil, as before remarked, is the pabulum of plants—that is, oil subtilized by the salts in a compost dunghill, left there for a considerable time in a state of putrefaction, and until the whole has become putrescent, then it is believed to be the richest possible manure.

The barley evidently proved its excellence. A ridge of summer cucumbers in my garden pointed out to many its great power, the leaves being in general from ten to ten and an half inches broad, and the vines occupied an uncommon space of ground. Five hundred cabbages planted by the side of four thousand more, and with only one handful of the oil manure, put into each hole by the dibble at the time of planting, were evidently near as big again as the others.

INQUIRIES ADDRESSED TO FARMERS.

[With a view to collect the most accurate information on the principal branches of agriculture, as now practised, the following queries are addressed to intelligent farmers and to Societies instituted for the promotion of agriculture. The answers subjoined are from the DANVERS AGRICULTURAL SOCIETY.]

Danvers, January 14th, 1815.

[To the Trustees of the Massachusetts Society for Promoting Agriculture.]

GENTLEMEN,

SINCE the formation of the Danvers Agricultural Society considerable time has elapsed; you have perhaps been disappointed in not receiving communications from us sooner. We have not however been entirely idle. The answers we now send to your questions are the result of considerable labour. We have had many different opinions to consult and reconcile. They have been discussed repeatedly at our quarterly meetings, and should they prove neither interesting to you, or the public, as friends of agricultural improvement it will afford you some satisfaction, to be informed that they have been advantageous to ourselves.

ANDREW NICHOLS,
Corresponding Secretary.

Question 1. OF what quantity of land do the farms in your vicinity generally consist?

Answer. The farms of those who make agriculture their entire occupation, contain from forty to one hundred acres; and will average about seventy-five acres. There are many who follow gardening, that cultivate from five to twenty acres.

Q. 2. What is the quality of the soil?

A. The land is generally uneven. Where it rises into large swells the soil is strong and moist, in most places full of stones, which render it hard to cultivate; but when it is subdued, it yields a crop proportionate to the labour. There are also several plains of considerable extent, some of which are sandy and others clayey. There are likewise many swamps and low fresh meadows.

Q 3. Into what portions of pasture, mowing and tillage, orcharding and wood, are farms usually divided? Are the orchards

improving or declining? Do they yield a competent supply of cider?

A. Mowing, tillage, and orcharding, constitute about one third part, pasturage one half, and wood land one sixth. Orchards are in a thriving condition; much attention has been paid to them within the last fifteen years. The young orchards are generally grafted, of which the best apples are not made into cider. More cider is however made than the farmers consume, but not sufficient to supply the inhabitants of the town.

Q. 4. How much land on each farm is annually (on an average of years) planted or sown with grain of any kind?

A. On a medium farm there are planted and sown with grain from eight to twelve acres.

Q. 5. In what manner is the land prepared, manured, and seeded with each kind of grain, and what is a medium crop?

A. For Indian corn, the land is usually ploughed once, and broken to pieces with a harrow. The manure is generally placed in hills about four feet apart, and the seed dropped upon it. It yields from twenty-five to forty bushels per acre. For barley, which is the principal grain sown, the land which had been for one or more years previous planted with corn or potatoes, is prepared by ploughing twice and harrowing once. Two bushels of seed are sufficient for an acre, which yields about twenty bushels. Within two years some attention has been paid to the cultivation of Londonderry wheat, but not sufficient to determine whether it will be more or less profitable than other kinds of grain.

Q. 6. In what manner is Indian corn cultivated, and what is the medium crop on an acre?

A. After preparing the ground as above mentioned, Indian corn is planted in hills about four feet apart; and is usually hoed three times. It is usually planted in the month of May. Some attention is paid to the selection of seed; the best part of the soundest and fairest ears is chosen. The stalks are cut as soon as the kernel is fairly filled and turned; if they are cut sooner the corn is injured. It should remain in the field till fully ripe, for no where else will it dry so well as on the stalks.

Q. 7. What is the quantity and value of the straw on an acre of barley, rye, oats, and wheat *respectively?* And to how much upland hay are they *respectively* equivalent for fodder?

A. Of barley and oats, from one to one and an half tons, equivalent to one third the quantity of upland hay. Rye and wheat are very little raised.

Q. 8. What is the value of straw of each kind, for any purpose, *other than fodder or litter?*

A. So little is used for other purposes as not to enhance its value.

Q. 9. What is the value of the stover or stalks on an acre of Indian corn, and to what quantity of upland hay is it equivalent for fodder?

A. From eight to twelve dollars—equivalent to one half the quantity of upland hay.

Q. 10 What quantity of land, on a medium farm, is annually planted with potatoes? How is the land prepared? What quantity and kind of manure is applied to an acre, and in what manner? How much seed is used, and how is it selected? How are they cultivated, and what is a medium crop?

A. From one to one and an half acres, on a medium farm, is annually planted with potatoes. The land is prepared by ploughing once and harrowing. From ten to twelve ox cart loads of coarse manure put into holes on an acre. The potatoes are dropped on the manure in hills from three and a half to four feet apart. Not much attention is paid to the selection of the seed generally, although it would doubtless improve the crops to plant the largest and fairest only: about twelve bushels are allowed to an acre. Ploughed and hoed twice: an acre produces from one hundred and thirty to one hundred and eighty bushels.

Q. 11 How many bushels of potatoes are equivalent, ordinarily, to one bushel of Indian corn, for sale?

A. Potatoes sell from thirty to forty cents per bushel—the price of corn has been much more fluctuating: the price of the two articles therefore at present, admit of no comparison.

Q. 12. How many days labour of a man, are usually employed on an acre of Indian corn, including the getting in all the stover and stripping the husks from the ears?

A. From fourteen to seventeen, exclusive of a team.

Q. 13. What is the labour of shelling a hundred bushels of Indian corn, and in what manner is it performed?

A. If threshed, which is the quickest way, from three to four days.

Q. 14 How many days labour of a man are usually employed on an acre of potatoes, including the getting in the crop?

A. From ten to fourteen, exclusive of a team.

Q. 15. Is there any order or succession of crops known to be beneficial or pernicious to the soil?—If any, what is it?

A. Any crop taken from the soil is supposed to impoverish it, excepting grain when the stubble is immediately ploughed in. Some crops injure the soil however much more than others.

Q. 16. What is the usual course of crops?

A. Grass ground is usually ploughed up in April or May, sometimes in the preceding autumn, and planted with corn or potatoes two or three years; it is then sown with barley generally, sometimes with oats or flax, and grass seed, clover, herd's grass, and red top.

Q. 17. What is the medium quantity of hay produced on an acre of upland, and what is the labour of mowing, curing, and housing it?

A. From fifteen to thirty hundred; labour from three to four days.

Q. 18 What is the medium product of hay on an acre of fresh meadow, and what is the labour of mowing, curing, and housing, or stacking it?

A. From fifteen to twenty-five hundred; labour about three days.

Q. 19. What is the proportion of value which fresh meadow hay bears to upland hay, each being of a medium quality?

A. About one third.

Q. 20. Is any tillage land laid down with grass seeds without sowing grain at the same time? If so, which method is found best?

A. Seldom if ever.

Q. 21. What are the kinds of grass cut on the upland for hay? What proportion is from seed sown by hand, and what are the kinds thus sown, and in what quantities *respectively* per acre?

A. Herd's grass, red top, spear grass, red and white clover, mixed with a variety of other grasses natural to the soil. The proportion of grass from seed sown by hand, it is impossible to calculate with any useful degree of accuracy. The only kinds sown are herd's grass, red top, and red clover. The proportion in which these seeds are generally sown, is herd's grass six quarts, clover three pounds, and red top three quarts.

Q. 22. Are any grass lands *new* seeded after scarifying them with the harrow only, or in any other mode, without ploughing? And what is the success of such practice?

A. We are unacquainted with any such practice.

Q. 23. What weeds, vermin or insects infest the mowing lands?

A. White Weed (Chrysanthemum Leucanthemum,) Flea Bane (Engeron Canadense.) Yellow Butter-Cups (Ranunculus Aeris,) Wood Waxen (Genista Tinctoria.) most troublesome in pastures; St. John's Wort (Hypericum Perforatum,) the Canada Thistle (Cnicus Arvensis) is beginning to make its appearance by road sides. Whether it will spread in our soil with the rapidity it has elsewhere, or not, is yet unknown. Farmers would do well to watch the movements of this formidable enemy. It is distinguished from all other thistles by its small leaves, small purple flowers which are numerous, and by their being no prickles on the heads, (Calyx,) White Grass,—worms and grasshoppers.

Q. 24. Are the spontaneous or cultivated grasses infested most?

A. The spontaneous woodchucks are very destructive to red clover.

Q. 25. What methods are used to destroy weeds. vermine or insects without ploughing the land, and what is their success?

A Wood ashes and salt mud are frequently spread over land to destroy weeds, vermine or insects with considerable success.

Q. 26. What kinds of beasts, and in what numbers are they respectively kept, on medium farms? And how are they subsisted?

A. On a medium farm there are usually kept one horse, one pair of oxen, seven cows and six sheep. These are usually purchased at an age fit for the team or dairy, and consequently but few young cattle are kept. Horses and horned cattle are pastured in the summer, and fed on hay, stover, straw, grain, carrots, turnips, pumpkins and potatoes in the winter. Concerning hogs, *vide* answer to question 33.

Q. 27. In what place and in what manner are the cattle fed with the coarse winter fodder? Is it given in the stable, in the yard, or in the field? Is it chopped or given whole?

A Cattle are fed in the stable at night and in the yard with the coarse fodder during the day. Fodder of any kind is seldom chopped. The coarsest is given first; the best is generally reserved for spring.

Q. 28. How much butter is usually made in a year from a cow, all the cream being churned? And how much skim-milk cheese is made from this same cow?

A. One hundred pounds of butter and fifty of cheese.

Q. 29. What food is given to sheep besides grass and hay?

A. A small quantity of grain, turnips, carrots and potatoes.

Q. 30. What is the value of the subsistence of a sheep through the year, besides the pasturage?

A. While the ground is bare, many farmers suffer their sheep to graze in the day time. In such cases the expense cannot be accurately calculated. Where they are well kept, housed and in yards, the expense is not less than three dollars. They will eat two pounds of hay daily, besides a gill of grain and as much of the above mentioned vegetables.

Q. 31. What is the value of pasturage for a sheep compared with the pasturage of a cow?

A. Three sheep and their lambs will eat as much as a cow.

Q. 32. What is the ordinary weight and value of the flesh of a sheep when fit for the butcher? And what is the quantity of wool in a fleece?

A. Sheep on an average weigh about forty pounds, worth two dollars in market; the tallow and skin without the wool will pay for marketing. The fleeces weigh from one and an half to two and an half pounds.

Q. 33. What breed of swine are propagated? How are they fed? How fatted? At what age are they killed; and what do they then weigh?

A. The common hog, a few of the Chinese and a mixture of the two breeds. They may be divided into three classes. 1st, Spring pigs, which are killed when about nine months old. These are kept on the wash of the kitchen and dairy in summer, and fatted on corn and meal in autumn, and weigh from one to two hundred. 2d, Such as are purchased out of the droves from the interior of the country, in autumn and winter. These are kept on the refuse of the kitchen, and potatoes in the winter, and on the same as the first mentioned class in the summer and autumn, and are killed when from eighteen to twenty-one months old, and weigh from two to three hundred. 3d, The same as class first, but kept in the same manner as the last mentioned until they are about twenty-one months old, and weigh from three and an half to four hundred.

Q. 34. What number of bee hives are kept? What is their product in honey and wax? What is the management, and what are the obstacles which discourage their extensive propagation?

A. The number of bee hives kept is small. Their product is also small compared with what it formerly was. The hives

are made of boards, set in a warm place fronting the south, sheltered from the wind and from the sun in the summer. They are allowed to swarm and are hived in the usual manner. Some years since, to prevent their swarming, some placed empty hives under the full ones: this is however now seldom practised. In taking the honey, the bees are uniformly destroyed by the fumes of sulphur. They afford but little profit. This may be owing to several causes, two are obvious:—there are a large number of stores of West India goods in this vincinity, where great numbers of them are annually destroyed—birds have increased which are known to prey upon them. Notwithstanding these obstacles it is not improbable, that if the owners would acquaint themselves more thoroughly with the natural history of this valuable insect, and with the bee master's science, such improvement might be made in the management of them as would amply compensate them for their time and trouble.

Q. 35. What is the usual quantity of land sowed with flax seed? How is it manured and cultivated; and what is the medium produce of flax and seed in quantity and value?

A. About one fourth of an acre. A rich soil well manured the preceding year is generally chosen. It is prepared by two or three ploughings. One and an half bushels of seed are usually allowed to an acre. One fourth of an acre produces about sixty-five or seventy pounds of dressed flax, and about two and an half or three bushels of seed. The whole worth about sixteen dollars.

Q. 36. How much labour is employed on a quarter of an acre of flax, before it comes to the spinner, and including the preparing the seed for market?

A. The labour of cultivating, preparing and dressing one fourth of an acre of flax is about ten days; a large proportion of which is done in the winter.

Q. 37. In what articles consists the surplus of the farmer, which is sold or exchanged for other articles?

A. Hay, corn, potatoes, barley, pork, beef, butter, cheese, cider, apples, and poultry.

Q. 38. How many loads of manure are collected (estimating thirty bushels to a load,) from the cattle in the barn yard, of a medium farm, in a year, specifying the number and kinds of cattle kept on the same farm, and the manner in which they are kept in relation to confinement or ranging abroad?

A. On a medium farm, on which are kept one horse, one pair of oxen, seven cows, and six sheep, the usual quantity is from forty to fifty loads, where the cattle are confined to the yard during nights in the summer, and in the winter the greatest part of the time.

Q. 39. What quantity of manure is made in the hog-pen? specifying the number of swine fatted, the kind and quantity of food consumed, and the weight of flesh produced?

A. In a hog pen, where two hogs are kept, about eight loads. Some however make much more. Respecting the kind of food, &c. vide answer 33.

Q. 40. What methods are used to enlarge the quantity, improve the quality, or prevent waste of the manure, made in the barn-yard or hog-pen, and especially to save the stale of the cattle?

A. To enlarge the quantity of manure and save the stale of the cattle, the yards when cleared are covered with rich mould taken from places which receive the wash of roads, &c. Coarse hay, weeds, &c. are occasionally thrown in: and to improve the quality, sea weed, and sometimes lime are added.

Q. 41. Is the manure and tillage labour exclusively applied to the best parts of each farm?

A. It is the common practice to plough, till and manure all the upland mowing ground in succession.

Q 42. In what manner and for what purposes is manure used, except those indicated in the foregoing inquiries?

A. Manure is frequently spread on mowing lands, and is also advantageously applied to young fruit trees, once in three years.

Q. 43. What other manures are used besides those created by the stock, and what are their merits compared with these?

A. Leached ashes, peat ashes, and salt mud taken from the flats and muscle beds, are all good manures. Sea weed and rock weed are used as a manure for potatoes, and are sometimes spread on grass land, but are more frequently thrown into barn yards and hog pens, to increase and improve other manure.

Q. 44. Is lime-stone found in your vicinity? Is it used as a manure?

A. None found.

Q. 45. Is Buck-wheat cultivated for the food it yields? or is it used to cleanse the soil from weeds, to fertilize and enrich it, or for any other purpose?

A. Buckwheat is sometimes cultivated for a green dressing, and is ploughed in, and the ground planted with potatoes about the 10th of June.

Q. 47. How is land cleared, which bushes and under-brush have over-run, since the trees were carried off?

A. By mowing, burning, ploughing and planting potatoes?

Q. 48. What is done with swamps, or swampy lands?

A. They are drained, the bushes destroyed by repeated cuttings, and if unfit for peat, are sometimes covered with gravel, four or six inches thick, and sown with grass seeds. Generally, however, the bushes being killed, they are left in this natural state, to produce coarse fodder.

Q. 49. Is the growth of wood for timber and fuel equivalent to the consumption in your vicinity? If not, what measures are taken to provide against the inconveniences of future scarcity?

A. It is not equivalent to the consumption in this vicinity. The means of providing against future scarcity are propagating the locust in our pastures, which not only grows rapidly and produces the most valuable kind of wood, but also increases the quantity and improves the quality of the seed. Improvement in the construction of the houses and fire places and the general use of peat.

Q. 50. Are wood lots generally fenced, or left open for cattle to range in without restraint? In getting your wood for fuel, do you pick the oldest trees, or do you cut clear? Which method is best calculated to increase the value of your wood lands?

A. Young wood is generally protected by fences from horned cattle. On the other question, farmers are divided in opinion and in practice. Perhaps much depends on the kind of wood and wood-land. Where the wood is all growing and the calculation is to save it for fuel only, it may be as profitable or more so to cut clear. Where many of the trees are decaying, or the object is to save valuable timber, it will do much better to pick out the decaying, and thin the crowded places.

Q. 51. What are the causes that the culture of wheat can no longer be pursued on the sea coast of New England?

A. The easterly winds are supposed to blight it. The seed raised in this vicinity does not answer so well to sow again as that brought from a distance Barberry bushes, which are plenty in this town, have been supposed, both in Europe and America, to injure grain. "This some distinguished philosophical agriculturalists have declared unfounded." Some of our farmers, how-

ever, assert from observation, that not only wheat and rye, but also barley is essentially injured near barberry bushes. The subject is worthy further investigation and experiments.

Q. 52. How far has Gypsum, (Plaster of Paris,) been fairly tried as a manure in the maritime parts of this state? What have been the effects of the experiment?

A. Gypsum has been but little used in this vicinity; it has been tried and proved not beneficial.

Q. 53. Is the European practice of a succession of crops found to be expedient in this country, and in what order ought such a succession of crops to take place?

A. Succession of crops is generally practised,excepting on low, wet lands. The order that generally prevails is as follows:—First, and frequently second year, corn or potatoes—the year following barley, oats or flax. Sometimes the stubble is ploughed in soon after taking off the crop, corn planted the next year, and the year following sown down with barley, or oats and grass seed.

Q. 54. Is it perfectly ascertained, that with attention to manuring the land, it is more advantageous to change the crops than to keep it in grass?

A. It is found necessary to change the tillage lands on account of their becoming weedy. Low and moist lands occasionally manured, are more profitably kept in grass.

Q. 55. Is there any crop so profitable as grass, taking into consideration the state of markets in our country, and the distance that most of our farmers are from market?

A. In this vicinity no crop is more profitable than grass.

Q. 56. Can farmers raise any crop which, on the whole, affords them so great a profit as grass, unless they are within twenty miles of the capital?

A. Not applicable to us.

Q. 57. What are the most profitable crops which the state of Massachusetts, taking one year with another, furnishes?

A. In this vicinity Indian corn, potatoes, carrots, onions, and grass.

Q. 58. What has been found to be the difference of profit between the Merino sheep, and the sheep which formed our former stock?

A. The subject of this question has not yet been so correctly ascertained as to authorize an answer from us.

Q. 59. Is there any cheap fodder which can be raised for sheep during the winter, which will supersede or diminish the consumption of hay?

A. Wood Waxen (Genesta Tinctoria) was imported for this purpose. It has overspread and rendered of little value, thousands of acres of land in this vicinity. Sheep will eat it, both green and dry, but if kept entirely upon it, although it will keep them in flesh, it is said to render them weak. Could it be confined to barren lands, for it flourishes where nothing else will grow, it might be valuable; but its encroachments on land more valuable for other purposes cannot be restrained without much care and expense.

Q. 60 What is the comparative profit of a farm adapted to the raising of sheep, between the cultivation of Merinos, and the raising of any other cattle?

A. Not ascertained.

Q. 61. Is there any profit derived from the raising of Indian corn, except for the subsistence of man, which can equal the employment of the same land in raising grass for the support of sheep and cattle during the winter? What are the calculations on which such profits are founded?

A. It is considered profitable to give horses, oxen and sheep Indian corn. The working cattle will be enabled to perform enough more, and the fleeces of the sheep will be so much improved thereby, as to pay well for the extra expense. It is not generally given to other cattle, although the profits of the dairy would probably be increased thereby. No particular calculations, however, have been made on the subject.

Q. 62. What are the improvements in dairies, which have been made within the last twenty years? Is the quality of butter and cheese improved? And in what consists this improvement? And what are its causes?

A. None; not generally known.

Q 63. Are there any improvements in the tools of husbandry, which experience has confirmed, and what are these improvements?

A. None.

Q. 64. Are there any new and valuable fruits or productions, either contributing to the pleasure or profit of the citizens at large? What are they? What the mode of culture, and what their qualities?

A. None.

Q. 65. Are there any improvements in the breed of cattle? What are they, what their qualities, and where can they be obtained?

A. None.

Q. 66. Are there any other improvements, not comprised under the articles of manufactures, which have been made in any branch of agriculture?

A. None.

P. S. We expect soon to send you an answer to your inquiry respecting the quantity of wheat raised in this town.

Yours, &c.

ANDREW NICHOLS.

ORIGINAL LETTER FROM JUDGE PETERS OF PENNSYLVANIA, WITH REMARKS ON THE CULTURE OF CHICCORY, THE MANGEL WURTZEL OR SCARCITY ROOT, &c.

[Addressed to the Hon. Josiah Quincy, Esq.]

DEAR SIR,

It is very difficult to obtain materials for any agricultural publication, either original or foreign. The first is precluded by the general disinclination of farmers to write on the subject, though they will consume hours in relating their own performances. One may pick up some information from them in this way; but new or useful facts are *rari nantes in gurgite vasto.* In a country society in my neighbourhood, we follow the Connecticut mode. Every one gives, in turn, a verbal account of any circumstance that has happened under his observation, of an agricultural nature, since the last meeting. The secretary sets down, in a rough minute book, the substance of the information. Every year selections of the facts are, (or ought to be) made. We are put to the necessity of filling up our volume with foreign matter, some of which is preferable to domestic communications. It is certainly a mark of illiberality and folly, to reject knowledge and information, because they were the growth of a foreign country.

I am pleased with your perseverance in your *soiling* plan, because it will test its utility or disadvantage. I sent to you the chiccory seed for trial, as it is so highly spoken of by A. Young and other British writers, as well as German and French agriculturalists, as a plant for soiling preferable to all others. It is no favourite of mine. A. Young assisted in getting the seed, part of which you have. I have it growing in my garden, luxuriantly. The root is a fine winter esculent, when the pith is disengaged. Plant the roots in a tub, and place it in a warm room in winter, and the roots throw up profusely a fine sallad. In foreign countries an imitation of *coffee* is made, by grinding the dried and burnt roots, and mixing a little real coffee with the ground roots. See Young's annals, and judge for yourself.

You will see what I know about the *mangel wurtzel*. I have never heard of any one else, in this country, who has given it a fair and persevering trial. I have not equalled the English or German cultivators; but I am perfectly satisfied with what I have actually experienced. Last year I failed, from having planted it in improper soil, (too light and sandy;) and if any other had failed, as I have done, the root would have been pronounced good for nothing. The roots of my last crop are better than carrots, turnips, or parsnips, which I have raised extensively in field culture. But they are inferior to *good* scarcity roots. Those are the worst which I did not strip. In compliance with the suggestions of the objectors to topping carrots, I have had carrots, in great quantities, as thick as my arm or small of the leg. I do not remember to have *cut* the tops off, but I always *strip* them, leaving the heart leaves at the *last cleaning*. I frequently trample or roll down the tops of luxuriant carrots and parsnips, and they yield a far superior root. *Your* experiment contradicts my experience. It seems a very fair trial, and not to be doubted as to its result. Try *stripping*, and omit *cutting*, and do it about the middle of the season. When the tops are too young, I know taking them off is injurious. Much depends on the state of the plant. Over-luxuriance in the tops, always causes inferiority in the root. Sometimes potatoes are wonderfully increased in size, by mowing off the tops. At other times, I have known them entirely ruined by it. There must be some state of sap or season, good or bad for such operations. When will agriculture be a *science*, teaching fixed principles? For a period of two thousand years, at least, it has

been an *art*, enlightened only by individual facts, too often clashing and ill defined.

Very sincerely yours,

RICHARD PETERS.

REMEDIES FOR CERTAIN DISEASES IN SHEEP.

BY A MEMBER OF THE EAST ANDOVER AGRICULTURAL SOCIETY.

[Communicated by that Society.]

[We refer the readers of this article to some remarks of Chancellor Livingston "on the excretory duct in the feet of sheep," which may be found at page 163 in No. 2, of this volume of our Journal.]

It is a maxim generally admitted, that "in the progress of investigating any subject, we ought to proceed from known facts to what is unknown." And we are as often perhaps mistaken as to the facts, as we are in our theory. It is therefore by no means surprising, that in our inquiries we are often forming suppositions instead of just conclusions. "Those suppositions being handed down from age to age, acquire additional weight from the authorities by which they are supported, till at last they are received as fundamental truths;" whereas we ought to trust to nothing but facts. Thoroughly convinced of these truths, and wishing them to be strongly impressed on my own mind, as well as on the minds of others, has led me to the above introduction on what I have to offer for your consideration on some of the common diseases of sheep.

In the early part of the last summer, while I was engaged in making some observations and experiments on sheep, I was informed by one of my neighbours that it had been lately observed to him, that the dysentery or flux in sheep was readily cured by simply rubbing with a "cob between the sheep's hoofs." On examining a sheep, which had been suffering with that disorder for two months or more, there appeared in the chink of the skin just above the hoof an orifice sufficiently large to admit a large sized knitting needle, and there was a kind of wax-like substance covering the mouth of the orifice on each of the feet, which I removed, and then rubbed the parts freely with a cob and woollen cord, and kept the sheep in the barn till the next day, and

then repeated the operation, and turned him to the flock without using other means. Nothing since has appeared of the disorder, and the sheep came to the barn this winter quite fat.

Since which I have examined many sheep, and have generally found at the mouth of those orifices and quite up into the opening, the same kind of matter, more or less inspissated. Late this fall, in two of my sheep that appeared unhealthy, one of which had a bad cough, I opened the mouths of those drains, rubbing the parts freely, since which they appear quite healthy and vigorous, and no other means were employed. After mentioning the circumstance to my neighbours, one of them informed me, that on examining one of his sheep that was quite sick, and (as he supposed) would soon die, he found that the substance lying in the mouth of the orifice had become so dry and hard, that it "broke like a dry stick." He removed the substance, gave the parts a faithful rubbing, doing nothing else for the sheep, which in a few days got well, and has so remained. Whether the return of health in those sheep has been produced by this simple remedy, or some other cause, I do not undertake to say; but I am inclined to believe, that nature has designed those openings as salutary drains, and when once obstructed, may become the cause of various disorders. And may I hope that the above hints may be a means of calling the attention of those, whose leisure and talents will bring the truth to light?

It has by some persons been said, that the merinos are more subject to disorders on the skin than our common sheep. Whether that is, or is not the fact, I will not undertake to say, from the little experience I have had on the subject; but will state only the remedies I have used in their disorders, and what *appears* to be the effect.

Sometime in the latter part of July last past, we discovered that one of our best half blooded merino lambs was very sick, and on examination, found the back covered with large live maggots; and on searching for the cause, I thought I had discovered several punctures, and concluded they were made by the dog. As I have been much pleased with the effects of using smoke in punctured wounds, and as I concluded the smoke would readily destroy maggots, I was at once determined to try it. The maggots were sooner killed than I expected where the smoke of the tobacco was forcibly thrown by the pipe to the parts. The sheep had become so poor and sick, as to be hardly able to stand, and

were kept in a close by the house, and smoked every day, for three days, with tobacco and woollen rags. I then washed with salt and water, sheared off the wool to discover the wound, and found I was mistaken in my first conjecture; for instead of a wound, I found an inveterate disease on the skin, extending from the hips to the shoulders, with a free discharge of matter that had spread down the sides of the sheep. I found also, that where I at first suspected a wound, and had applied the smoke more freely, the discharge was drying away. I continued the smoking with old woollen rags, and occasionally washed with soap and water. The wool in a short time was entirely off from his back, and partly down the sides where the skin appeared dry and hard; for which I applied an ointment of hog's fat, mixed with flour of sulphur, and kept him tied for about ten days, that the disease might not be communicated to others of the flock; I then turned him out well, and he has remained so to this time, and was selected a short time since by one of my townsmen among six others, as the best to put to his ewes this season. I gave no other medicine, and used no other remedy. Soon after my sheep got well, one of my neighbour's sheep was taken with the same disorder, though not yet so bad—the same remedy was applied—the disorder soon gave way, as we think, to the smoke, and in a few days was well.

In a wound on the head of a sheep made a short time since by a dog, the teeth of which had penetrated deeply at the ear and at the eye, and at other places several smaller lacerated wounds were made, we applied the smoke with every appearance of the like good effect.

I am the more inclined to have a confidence in the above remedy from believing in the antiseptic quality of smoke, which may possess or convey a considerable quantity of the carbonic acid gas, as well as from the astonishingly penetrating powers of smoke as such. But I forbear to reason on the subject, leaving that for men of learning and of leisure, contenting myself with simply stating what have appeared to me as facts—hoping the remedy may have a fair trial that the truth may fully appear.

To the Trustees of the Mssachusetts Society for Promoting Agriculture.

GENTLEMEN,

I AM this moment requested to give a copy of the above, to be sent by Mr. M. Morrell, of this town, to your Society. Want of time prevents my copying and correcting it. If sent at all, it must go with "all its imperfections." I shall not attempt an apology, for I have, gentlemen, attended to your *preface* of No. 1, Vol. III.

A member of the Agricultural Society in East Andover.

To the Recording Secretary, Boston.

January 28th, 1815.

EXTRACTS FROM "THE RURAL SOCRATES;" OR, AN ACCOUNT OF THE HUSBANDRY OF A PHILOSOPHICAL FARMER, LATELY LIVING IN SWITZERLAND.

[Hallowell, District of Maine. Edition 1800.]

Small farms, well cultivated, more profitable than large farms ill cultivated.

KLIYOGG thought that a small farm well cultivated, is more productive and more profitable than a large farm ill cultivated. He appears in this to have formed a just decision. A large landed property kept under cultivation, implies a large investment of capital in the soil, large taxes, large fences, and large ploughings; such a property is not easily travelled over by the proprietor, by his laborers, or by his teams; it is more difficult to inspect it from the farm house by the eye; more impracticable to protect it from robbery and inroads; it demands more attendants and more seed; when it becomes likewise the common system of others in the country, it will be found from the large size of each farm, that the market, the church, the neighbour, and the artisan's shop, must each in effect be thrown at a greater distance; roads also becoming longer, must thence be kept in worse repair; the country will be found less populous within the same extent; and negligent habits will too certainly prevail in every thing, which will in time seize even the moral character of the cultivator.

"Columella relates a story from Grœcinus in confirmation of this. A man had two daughters and a large vineyard, of which he gave a third part with the eldest daughter in marriage, and yet he gathered as much fruit as he did before. Afterwards he married the younger daughter, with another third for her portion, and still found that his remaining third part produced as much as the whole had done, which could arise from no other cause, than that he was able to cultivate a third part better than the whole vineyard before it was divided."

Oxen more profitable on a Farm than Horses.

Kliyogg finds his horse more expensive than serviceable, and seems determined to sell him, and lay out the money in oxen. A horse, he says, is a very expensive animal. He requires the same quantity of hay as an ox, besides oats and shoeing, to the amount of a pistole yearly. The value of a horse decreases with years; whereas an ox, when old and past labor, may be fattened and sold for his master's benefit. In a word, he computes that two oxen may be maintained for one horse;* and, it may be added, that horse-dung is by no means so beneficial to land, as the dung of horned cattle.

The advantages which Kliyogg derives from his cattle are, first, milk and butter, for family uses; secondly, work; thirdly, *manure*. He very rationally considers the last article (manure) as the basis of the improvement of the soil; consequently he has applied the whole force of his care and industry towards its accumulation, and has so well succeeded, that from his small number of beasts, he collects yearly about a hundred tumbrel loads.† This is double the quantity he gathered the first year of his farming, (which yet was equal to what had been done by any

* This determination of our cultivator is very remarkable, and should be attended to by all English farmers and others, who have an opportunity of making a choice between horses and oxen for the works of husbandry. This peasant attended to the minutiæ of the comparison with an accuracy unattainable in his superiors. He worked them, fed them, and performed every office relative to them, *himself*. How particularly judicious therefore must be his ideas of the matter! The proportion of *two* to *one* is a prodigious superiority, absolutely decisive. It is the discovery of a proportion that was greatly wanted in husbandry, and should be kept in memory as a point of knowledge.

† Tombereau.

husbandman in the village,) and led him to conclude, "that the generality of farmers have too great a proportion of live stock to their ground." This conclusion appeared to me at first very extraordinary, and almost tempted me to believe my philosopher a man of paradox and singularity. But his explication of this ænigma, satisfied and undeceived me. "When a farm," says he, "is overstocked, the farmer is forced to send his cows, in the summer months, to graze on commons at a distance from their sheds, which is the loss of so much to the farm-yard. The poverty of these commons reduces their milk, and to remedy this inconvenience, the manger must be filled with fresh grass when they are brought home at night, which necessarily occasions a diminution of winter stores. Scarcity of hay must imply a call for straw, which ought to have been entirely appropriated to the use of the dunghill, as without it no improvement of soil can be expected; besides which, bad food is the source of an infinite variety of distempers." In this manner the judicious Kliyogg pointed out a principal cause of the decline of agriculture in this country. It is a certain fact, that many of our farmers keep more cattle than they can conveniently support in winter. The arable and meadow lands are, by this bad management, deprived of part of the manure they require. The cattle being enfeebled for want of wholesome nourishment, particularly towards the spring, lose their milk or their laboring strength, and frequently die of diseases easily accounted for! These are melancholy truths which experience too well evinces!

Our sagacious husbandman keeps no more live stock than he can amply support with grass and hay from his own fields. The straw is carefully preserved and used only for litter, of which he is so liberal in his stalls that the beasts are buried in it up to the knees.*

Various modes of collecting and making Manures, with Remarks.

He is attentive also to gather all the dried leaves, moss, and rushes from the ground, that can serve for litter. The small dead boughs and pointed leaves of fir trees in particular, afford plentiful materials for this purpose; and he employs in this oc-

* A most excellent practice that cannot be too much admired. It is amazing, the quantity of manure that may be raised by such practices, when a man can command a plenty of litter. Y.

cupation the greater part of the time he can spare from his other work. A compost dunghill appears to him an object of so great importance to the improvement of land, that, of all branches of labour, he regrets the want of assistants in this the most; and waits, as a singular blessing, the time when his children shall be capable of contributing their share: so thoroughly is he persuaded that he wants only labouring hands to procure fifty loads more of manure, without increasing the number of his cattle.

In prosecution of this design in autumn, during the moon's increase, Kliyogg goes into his wood with a hedge-bill to prune the supernumerary branches of fir and pine trees, even of those which he thinks it useful to leave, boldly venturing to cut the lower shoots of young trees close to the trunk. These he binds into faggots and carries home, placing them under a shed till a proper season for prosecuting his work. At leisure hours, and especially in long winter evenings, he prepares these faggots for the purposes intended, an employment so little disagreeable or fatiguing, that it serves him for recreation. He begins with cutting the small boughs away from the larger ones, laying them with the pointed leaves of these trees in little heaps to be used for litter, while the larger and tougher boughs are reserved for fuel. By this method he amasses many proper materials for good manure, that are commonly suffered to rot uselessly in the woods, which is so much real loss to husbandry. To Kliyogg this discovery is an inestimable treasure, of which we were either ignorant or forgetful. The opinion is further verified in in Zellweguer's description of the mode of husbandry used in the canton of Appenzell. They scatter there dead branches of fir and pine-trees in great roads to be trampled by cattle and passengers, by which means they acquire a beginning of putrefaction, and are converted into manure though of a very indifferent quality. But Kliyogg, who had experienced how defective this method was, has succeeded in what at first seemed hard to accomplish; namely, converting these very materials into excellent manure. It is known that the resinous and aromatic juices contained in the prickly leaves of pines are powerful enemies to putrefaction; but what obstacles are not to be surmounted by reason, seconded by industry? Kliyogg subdued them all, by observing certain rules in the preparation of litter for his cattle, and of the different strata of his dunghill.

In regard to the first article, he seldom removes the litter under a week, strewing fresh upon the top once a day, by which means it becomes impregnated with animal salts, and acquires a very evident degree of fermentation before it is removed to the dunghill. An objection may arise to this practice, which I myself could not avoid making; namely, that the strong effluvia arising from the fermented litter, must be prejudicial to the health of the cattle. But Kliyogg assured me, that experience contradicted this; and thanked God that his beasts had always been remarkably healthful and vigorous. Nor does this method prevent cleanliness if a constant supply of fresh litter is attended to, and the cattle are, at the same time, more warm and comfortable.

This exactness is equally conspicuous in the management of the litter when taken away. It is placed in separate layers upon the dunghill; so methodized that those where the fermentation is soonest to be expected, may accelerate the putrefaction of others where it is more slow. In the beginning of autumn he litters his cattle with straw during two months; the next two months he litters them with twigs and spines (or pointed leaves) from fir and pine trees; then straw again, or rushes and dried leaves; then twigs and spines, and so on alternately.

The regulation of his compost dunghill is as follows: Lest the fermentation should be totally suppressed or even checked by drought, he is assiduously attentive to the preservation of a certain degree of moisture The celebrated M. de Reaumur, in his Treatise on hatching eggs in ovens or hot-houses. observes, that when the heat of the hot-bed decreases, it should be watered to increase fermentation. The sagacity of our philosopher has explained to him, that to obtain a manure thoroughly rotten he has nothing to do but to preserve a constant fermentation by frequent waterings. To facilitate this, he has sunk near his dunghill seven large square pits, which are planked with wood in the form of boxes. In these pits he keeps the prolific water, essential to so many operations. First, putting some thoroughly fermented cow-dung at the bottom of his wooden boxes, he pours in a pretty considerable quantity of boiling water, and then fills up the pit with fresh water from his wells; this brings on, in three weeks, a state of putrescence, which, without boiling water, could not be attainable in two months. He has thus a perpetual supply of corrupted water, as well for the purposes

of vegetation, as to keep his dunghill in a constant state of humidity.* But as the expense and labour of such a work might far exceed the profit, Kliyogg has thought of a means that, in a great measure, reduces both; this he calls, in his language, "going the shortest way to work," which is a fundamental maxim in all his proceedings. In pursuance of it, he dug a well in an orchard adjoining to his bleaching-ground, at a proper height, to convey whatever quantity of water he has occasion for, by a wooden pipe directly into the copper. His reservoirs of stagnant water are sunk below his stalls and stables, with the same view to conveniency. There is likewise a trough at the declivity of the dunghill to receive the water that drains from it, which gives an easy opportunity of moistening the dunghill frequently, without robbing the soil of its share of the stagnant water.

The success of this method of watering his dunghill, suggested an idea of putrefying small twigs of fir or pine, without using them for litter. He lays them in close heaps, pressed down, and covered with earth, to prevent evaporation; and pours stagnated water on them every day, till converted into rich mould.

* Were the encouragers of agriculture to compare what is here related with part 11. section 5, of that incomparable work of Dr. Francis Home's, entitled *the Principles of Agriculture and Vegetation*, they would certainly be struck with the exact similarity that appears in the practical husbandry of our judicious peasant, and the Doctor's precepts given as new observations. Kliyogg discovered them by the light of nature; Home, by his knowledge in chemistry! "Let us make," says he, page 61, "some practical observations with regard to the management of dunghills; for this is an affair of considerable importance, and in which farmers seem to be very ignorant. Dry vegetables require a considerable degree of moisture before they can be brought to putrefy. I think dunghills are generally kept too dry, as they are commonly placed on a high situation, and are themselves raised to a considerable height. A hollow situation, which will retain the moisture, is the best. Too much moisture is likewise bad. This may be prevented by having hollow places with clay bottoms at the side of the dunghill, into which the superfluous moisture may be allowed to run, and from whence it may be restored again by pumps to the dunghill at pleasure."—And again, "there are ferments for the putrefactive fermentation as well as the vinous." If the urine of horses and stall-fed cattle is carried into proper reservoirs, and there allowed to turn stale, it will, if thrown on the dunghill, very much quicken the fermentation. F.

Kliyogg is so perfectly convinced of the efficacy of heat in accelerating putrefaction, that he believes all soils, even the most barren, may be rendered fertile by warmth. Upon this principle he infers, that an *extremely hot dry* summer will be succeeded by a remarkably fruitful one. "Heat," says Kliyogg, "putrefies and enriches."* In consequence of this opinion he told me, about the middle of the winter 1759, that the ensuing harvest would yield three sheaves instead of two: the event confirmed the prediction. He repeated the same thing immediately after the drought of last year, which is verified in the present year of plenty, 1761. It will even appear that the earth has been more lavish in her productions this year than the pre-

* We shall be sensible of the truth of this observation of our judicious peasant, if we extend our reflections to those countries where the climate, without being excessively hot, is yet much warmer than our own; and where we shall find a much more vigorous vegetation, than can be accounted for from difference of soil or labour. Herodotus assures us that the lands of Babylon produced from two to three hundred ears of corn for one. Pliny says, that in Lybia, the proportion was one hundred and fifty: Chili produces from sixty to eighty and a hundred. The fertility in particular districts of Peru, is still greater; there are fields where the reapers gather four or five hundred for one, of all kinds of grain. Mr. Adamson, an ingenious naturalist, attributes the extraordinary fruitfulness of the sands of Senegal to the effects of *heat*. He informs us, that he sowed several sorts of leguminous seeds, which afforded twelve crops in a year. The never failing harvests of Sicily, Egypt, and part of northern Africa, are well known; as well as the ancient fertility of Corsica and Spain. Let us recollect the former fertility and population of the Holy Land. Let us cast a look towards China, and some particular provinces of India and Persia—and we shall be convinced at least, that all things considered there cannot be so great a proportion of manure, or of indefatigable labouring hands in those countries, as in our own. F.

Thus far the French translator. But it is not the hot summer in Switzerland which is fruitful; it is the succeeding one. A *fallow* occurs during the heat, which favors the succeeding crops; but is at the expense of the first crop.

The prolific vegetation of certain hot countries is owing to great and long heats, joined to a moist soil or air. *Long continued* growing weather is equivalent to two or three summers in the course of one and the same year; and therefore gives room for successive crops in the same year. For the same reason *inferior* soils in hot countries, if seconded by moisture, yield more in a given crop, than they do in the colder climates of the north. E.

ceding, if allowances are made for the north winds, which prevailed in the beginning of April.

Our indefatigable cultivator does not bound his improvements within the circle of that quantity of manure, which his industry procures from a small number of cattle. He buys every year seven tumbrel loads of dung from his neighbours, which cost him 1*l*. 10*s*. 7*d*. These he mixes with six tons of peat ashes, which come to about two shillings the twenty bushels. He finds the effect of these two kinds of manure answerable to the price.

Not satisfied with this, he turned his attention to other methods of enriching his land. With this view he took a journey into the bailiwick of Regensperg, where they use marle with great success; it being found in abundance below Laguerberg. Having made strict inquiries into its properties and the manner of using it, this species of improvement appeared to him so desirable, that at his return he made many unsuccessful attempts to discover marle in his own neighbourhood. What a pity that this examiner of nature should be a stranger to the use of the *boring instrument* in these inquiries! As a substitute for marle, his industry discovered a method of improving land that answered very near the same purposes, from a small *gravel;* of which I shall give a circumstantial detail when I describe Kliyogg's manner of preparing his land for corn. He likewise found in turf, cut from the surface of the pasture or fallow land where the grass is very luxuriant, proper materials, when well prepared, for rich manure. The preparation consists in exposing the turf for two years in open air, to all the influence of the seasons, till it is entirely decayed; when it may be spread with success on meadows or corn fields. Kliyogg never suffers prejudice of any kind to lead him to the rejection of new experiments, but thinks them all deserving of attention, and testifies his gratitude to the communicator. He apprehends, in general, that *all mixture of earths, where their nature is different*, contributes to fertility; nay, even where the distinction lies only in colour; and he has no doubt of improving a field, if at a moderate expense, he can contrive to carry fresh mould to it of a different quality. Thus a light soil, according to him, is improved by a heavy one; a sandy soil by a clayey one; a blue clay by a red clay, &c.

It is in these different modes of procuring manure, and in the continual pains to obtain it, that in the opinion of our judicious cultivator, the fundamental basis of agriculture consists. In truth, lands are more improved, and with less trouble, by proper manure, than by frequent ploughing or digging ;* notwithstanding Tull, an English writer, attempts to prove the sufficiency of the latter alone. Let it be granted to Tull, that manure has no other effect than to heat and render the earth more porous, from a fermentation excited. Is not not this effect more likely to be produced from the facility with which it penetrates according to its nature, the smallest particles of earth when in contact with them ; than from a simple division of these particles by an operation merely mechanical? It may likewise be added, that the oily and saline parts contained in manure are extremely conducive to the nourishment of plants: nor is it less certain than an union of these two methods of improvement, is the ultimate perfection of husbandry. It would be for the advantage of every farmer, if he had leisure, to plough his lands according to the rules laid down by Tull and his imitators, after having first well dressed them with proper manure.†

* Those parts of rural economics which have divided the opinion of the sup rior class of cultivators, will by them be very seldom determined Their ingenuity is too great to admit of entire conviction. The unprejudiced part of the world should in such cases, be determined by opinions totally unbiassed by *systems* Kliyogg's testimony in this affair coincides with that of the best husbandmen from the beginning of the world to this day ; and I have found it true from the proof of some hundreds of particular experiments on both gravelly and clayey loams. Y.

† " Frederick William, king of Prussia, an excellent financier in many respects, and who applied many great ideas to the detail of practice, reasoned very justly in making it an established principle of his political system, that *agriculture is the foundation of the opulence and prosperity of a state.* He encouraged it in the strongest manner, and made regulations in its favour, of which the wisdom was unperceived till after many years. The constant attention he paid to the observance of these regulations completed their salutary effects. This monarch had understanding to know (and all financiers ought to be proud of receiving instructions from a master) that the most stubborn and infertile soils are meliorated by manuring and ploughing ; and that rich lands are made still richer. He therefore insisted that the farmers of his demesnes, and the proprietors of estates in lands, should manure them sufficiently, and plough them deeply and frequently. *When the king was expected to pass through*

On the advantage of flowing Meadow Lands, with Remarks.

Laying meadow under water, furnishes a *second* means of improving the soil so extremely advantageous, that the difference is very immaterial between the crops of a meadow well watered or well manured.* This, indeed, greatly depends on the properties of the water, and the method of conducting it over the ground. Spring-water is, in Kliyogg's opinion, the best; especially when it can be procured immediately from the spring; for he observes that it insensibly decreases in virtue, in proportion to the distance.

I confess that I could assign no satisfactory reason† for such a diminution, but did not think myself authorized to dispute the

any of the provinces, the gentlemen, the farmers, nay even the peasants, thought they could not pay their court better, than in placing a large dunghill before their doors. A powdered courtier might sneeringly deny to this economical attention a place amongst the royal virtues; but the sagacious monarch was sensible, that these dunghills spread over the fields would produce a crop of ducats. He accordingly had the satisfaction to see, after reigning some years, the sands of the Marche of Brandenburg, and the heaths and morasses of Prussia, covered with a plentiful harvest of the finest grain in the world. The king, his son, supplied all that was wanting to bring this noble plan to perfection; and we have seen in a very short space of time, the sandy desart, that extended to the very gates of Berlin, converted into excellent land by a kind of economical enchantment." (Political Institutes, by Baron Bielfeld. Vol. 1, p. 181.)

This monarch in the year 1727, founded in the university of Halle, the first professorship of Rural Economy which had been seen in Europe; and the example has since been happily copied in many other universities of Germany. F.

* This is a part of husbandry strangely neglected in England, but of undoubted importance. I experienced it in my Suffolk farm, and yet stronger in my present Herfordshire one; where any person that will call on me, may see the vast difference between a meadow in the parts watered and unwatered. I had this year (1769) as much hay from off one watered acre, as all the other four unwatered ones in the same field. Y.

† The difficulty is not perhaps so great as may be imagined, to support this observation of Kliyogg's by philosophical reasoning. A deep spring preserves near its source, a temperature nearly the same in all seasons. From eight to ten degrees above freezing, is, according to *Reaumur's* thermometer, the greatest variation. But a stream, whose surface considerably exceeds its depth, will acquire, during the summer solstice, an increase of heat in proportion to its distance from its source. When

truth of his observation; having, on all other occasions, found in him those qualities necessary to form the accurate observer; namely, a facility in embracing luminous views of a subject, joined to a persevering attention and an entire freedom from prejudice.

He finds that water from mossy grounds is very injurious to grass, and destroys it entirely. Water loaded with calcarious grit-stone, may likewise be of the worst consequence to a meadow; so that the husbandman cannot attend too carefully to his water, otherwise his lands may suffer more from overflowing than from drought. Nothing ascertains the salubrity of water more than the production of cresses, brookline, and succulent

this is too great, it has been proved, that far from refreshing the grass, it turns it yellow and injures it in many respects. It is also customary in some countries to overflow meadow land in winter, especially towards the spring; when the water gradually melts the ice that may have lodged; for if this operation were left to the action of the sun, the effects would be too precipitate, and prove highly pernicious to the young blades of grass. One may naturally conclude, that the water best calculated for enriching a soil, has that degree of temperature already said to be inherent in water, near its source; and that a stream which from the length of its course has considerably augmented its original heat or cold, according to the season, must be more hurtful than beneficial. It is also to be remarked, that water taken near to its source preserves its original purity; while that which passes over different lands, may be impregnated in its course with particles of tufo, (or calcarious grit-stone) or contract a chalybeat or other vicious quality, which may render it injurious to the meadow over which it is to be spread. On the other hand, there may be instances of water being found pernicious to adjacent meadows, but salubrious to those more remotely situated; owing to noxious particles, which it may deposit in the beds of sand or gravel over which it runs, thus at length becoming purified. But it does not seem advisable to overflow any land with spring water either during the excessive heat of summer, or the intense cold of winter. Excellent remarks on the watering of land are to be met with in a memorial which carried the prize given by the Economical Society of Berne, inserted in their Journal, Vol. II. (sold at Zurich, by Heidegguer and Company, and at Paris, by Brocas and Humbolt of St. Jaques Street). F.

The annotator here, in speaking of the temperature of springs, forgets that this temperature varies in different climates, elevations, and exposures; corresponding, with considerable exactness, to the average effects of the sun's heat through the year in the place where the spring is found. E.

plants. But when a river is choaked with rushes,* spear-wort, or moss, its water will be destructive to vegetation.

The rules necessary to be observed in sluicing of lands, are, according to Kliyogg, to take particular care that the principal and dependent channels, be placed in a proper situation to distribute the water over as much of the meadow as possible. The direction of the principal trench ought to run across the most elevated part of the ground, in order to give a due inclination to the collateral branches; nor should it be cut too deep, which would prevent the inundation from being gradually extended over the whole surface. It is likewise essentially necessary to slope the trenches in such a manner, that the water may be carried off with facility, and no part remain stagnant, which would immediately occasion putrefaction; for the turf being once injured, the meadow would soon become swampy and the grass bad. It will also be necessary to change the trenches frequently, filling up those first made, so that every part of the land may reap, in turn, benefit from this operation. Our cultivator considerably augments the vegetative properties of the water by mould, procured, as I have already mentioned, from green turf cut from eminences in pasture or fallow land. This he throws into the principal head of water, so that the lesser channels may imbibe and communicate fertility over the meadow.†

Cattle not to be allowed to graze on meadow land late in the year.

The autumnal grass, which Kliyogg converts into manure, supplies him with a *third method* of improving his meadow; for he thinks it very hurtful to the ground to suffer cattle to

* This is occasioned by the seeds of mosses and rushes, which the water spreads in its course. Those of moss soon rise and multiply exceedingly, covering the surface of the ground and entangling the fibres of the herbage and grass, till they are stifled, without supplying any nourishing food in their room, for moss never rises high enough to be touched with a scythe; or, if hay could be made of it, the cattle would not eat it. To obviate this misfortune, cinders and ashes may be strewed, which will kill all kinds of moss. And rushes may be extirpated if they are carefully drawn out by the roots, and the ground drained that produces them. F.

† This is a good thought; but the benefit, on some soils, of casting *unslacked* lime into the stream would be much greater, and acquired at a much less expense. Y.

graze 'ate in the year.* Independently of the loss of so much manure, the beasts break the turf; and in a rainy season, which commonly happens in autumn, the impression of their feet forms so many cells for the water, and this water congealing in winter, greatly injures the roots of the grass. This is a new proof of the bad husbandry of maintaining a disproportionate number of horned cattle, which occasions the farmer to let them devour every blade of grass for their support, and run the hazard of robbing the earth of its best substance, till by degrees the farm is entirely ruined.

Kliyogg is not satisfied with the improvement of his meadows, but seeks to extend them; without however deviating from his grand principle, never to purchase more ground, till he has carried the culture of what he possesses to the highest degree of perfection it is capable of attaining.† How is it possible, says he, if a cultivator has not been able to cultivate properly what he already possesses, that he should be able to do it, if, by increasing his possessions, he still more overloads himself with care and work?

The fertility of an estate is always in proportion to the culture bestowed; nay, it will even be found, that if a man doubles his number of acres, and employs only the same number of labouring hands as when he had only half the number, that his estate will clear less than it did before the additional purchase. Thus it is evident, that a farmer may have too much ground, as well as too much live stock. For our conviction, nothing more is required than to take a survey of an overgrown farm badly occupied; where lands, with every advantage of situation, will not produce more than a fourth part of what lands of the same quantity and quality afford, divided into equal allotments, amongst the inhabitants of a populous village.

* This is most excellent advice; but through vast tracts of country in England, they suffer their cattle to remain in the fields all winter, and even feed with hay in the pastures. There cannot be a more execrable system of conduct. Y.

† I cannot read this work without expressing my surprise that a book which certainly contains many ideas of culture, equal, at least, to any that have been offered to the public, should have remained so long unknown in England. The most refined experience could not start a juster observation; it is a lesson to all the farmers of every country in the world.

Great crops of Grass and the coming in of profitable species of Grass, depends more on manuring well than on the choice of seed.

He is not very anxious in the choice of seed; for experience has taught him, that the difference of herbage depends entirely on the nature of the soil and the preparation of the ground. The same meadow that is matted with moss and every kind of unprofitable beggarly weeds, will produce trefoil of the best quality when improved by manure, adapted to its nature.* In this instance, we find a manifest proof of the infinite wisdom and goodness of the Creator. Let but the husbandman fulfil his part of the obligation by industrious culture, and leave the result to Providence. The most wholesome and nutricious plants will grow spontaneously; the winds will waft from distant fields the most useful seeds, which want nothing but a proper bed to make them vegetate, whilst noxious weeds, not finding suitable nourishment, will wither for want of the juices appropriated for them.

* Kliyogg, in this remark, displays his real experience. I have often made the same observation, but it should be limited; for if the nature of *perennial* plants be bad, manuring will improve their luxuriance as well as that of the best vegetables. The following instance, mentioned by that excellent cultivator, Sir Digby Legard, is a very strong proof. "I have often observed fields covered with white clover, where pasture has preceded arable land, without any person's remembering the sowing of it; and often, in an old worn-out meadow or pasture, a crop of this will appear after plentiful dunging. This fact of the white clover springing in great quantities on land, copiously manured, where there was before such manuring no appearance of it, is very curious; but frequent in northern parts of England and in Scotland. It is not confined to manuring with dung; but the same event follows, where a change of soil is made by lime or marle, laid on in great quantities. I have an account by me of an uncommon large crop, no less than three tons an acre being produced at Kedgely-Moor, in Northumberland, in consequence of a large quantity of lime being laid on some acres of black moor land covered with heath; the heath was entirely killed, and this great burthen of white clover succeeded, without any assignable means of conveyance of the seed. I find from other accounts, that the same commonly happens in the county of Galloway, where great quantities of such moor land have been lately brought into cultivation. Very copious manuring with lime, dung and marle, appears there to destroy the heath, and produce white clover."—*Memoirs of Agriculture*, Vol. I. page 366. Y.

Till lately, Kliyogg never heard of artificial grasses. The first account of them engaged his attention. The Philosophical Society of Zurich remitted him some pounds of Flanders trefoil seed (*trifolium pratense purpureum majus. Ray. Hist.* 944) requesting him to make some experiments. For this purpose he prepared a piece of ground near his house, in the manner I have described, and divided it into two equal parts; in one he sowed the Flanders trefoil; in the other, common grass seeds. Both divisions were manured in the same manner and carefully watered from the stagnant pools; and he accurately observed the comparative produce. In waiting the result, he made several other trials of the Flanders trefoil in smaller spots of ground, some richly manured, others of the same size in an unimproved state. These various experiments tended to convince him that this foreign trefoil, like the grasses common to our own country, was more or less luxuriant, chiefly according as the soil was more or less manured. In regard to the grand experiment to find the difference of produce from the seed of trefoil and that of common grass, in ground where the culture and preparation are the same, Kliyogg declares he cannot discern any that is material. It is much to be wished that sensible and unprejudiced farmers would take equal pains in making experiments on lucerne, saint-foin, and other species of exotic grasses, whose excellencies are so highly extolled in the present age; as by a calculation of their just advantages over our natural herbage, we should be able to determine whether the substitution of them would answer. Some enlightened friends of agriculture have already informed me, that the trials they have hitherto made, fall short of the desired success; and that they find it much more profitable to continue the old method of husbandry, than to use these articles of modern discovery; for instance, the Flanders trefoil, which, in supplying a very succulent nutrition, excites cattle to feed immoderately, and occasions very alarming distempers.*

*I should imagine the only thing wanting to prevent this inconvenience, is a due regulation of the quantity of trefoil which a beast may eat without hazard, and which never ought to be exceeded. A proportion not difficult to ascertain, with the assistance of a little attention and experience. The invaluable *Collections of Observations by the Agricultural Society in Britanny*, recommends, in several places, what to me appears an excellent method. "It had been remarked by the Baron de Pontual, that to fodder cattle with

Kliyogg made me attend to a circumstance which may prove the destruction of a meadow if not corrected. This is when the plantane is suffered to predominate; whose large leaves so totally cover the surface of the ground, that no other herbage can spring up.* He pointed to my observation a meadow, where the plantane was spread over the soil and reduced it to sterility. The sole remedy for this evil, in his opinion, is to plough up the meadow and sow it with grain for some years, and afterwards, in the manner already described, it may be converted into meadow again.

Importance of varying the Seed on the same ground.

Kliyogg likewise observes, that whoever is desirous of constantly plentiful crops, should be sensible how very essential it is frequently to vary the seed upon the same ground. Thus he is indefatigable in the search of new; and is so thoroughly convinced of the utility of this rule, that he affirms that there is an advantageous difference in the produce, if he buy seed at a village only four leagues distant from his own. This remark is worthy the attention of some curious naturalist.

trefoil only, heated them too much. A native of Flanders taught him to temper this heat by a very useful piece of economy Amongst the Flemings, where the meadows abound with this grass, they make layers in their hay-lofts six or seven inches deep, of straw and trefoil alternately The straw imbibes the scent of the trefoil so strongly, that oxen and horses eat both, with equal avidity. By this means the value of straw becomes equivalent to that of trefoil, and the cattle are preserved sleek and cool."

There is great probability likewise that Kliyogg was unacquainted with the best method for the culture of trefoil. The same *Observations* inform us, "That it succeeded very well when sowed with oats, which is the last crop in rotation before the ground is suffered to lie fallow. President de Montluc, who began to make experiments in 1758, has had remarkably fine crops of oats. At the time they were ripe, the trefoil was in great luxuriancy below, about two feet in height. The manure still remaining in the ground after the first crops are mowed, and the ploughing necessary for the oats are equally beneficial to the trefoil. Experience has convinced him, that with only the additional price of seed, a man may have, for several successive seasons, a rich meadow of trefoil, which may be mowed in most years twice, and in favourable ones three and four times." F.

* This is precisely the case in England; but the narrow leaved plantane, called in the north rib-grass, is an excellent pasture. Y.

Gravel, on some soils, a very valuable manure.

Our industrious laborer bestows on his arable lands a kind of manure, whose effects appeared singularly astonishing to me, when he took me into one of his inclosures a little before harvest. A third part of this field, from a deficiency of hands and leisure that year, had been without this manure. I instantly perceived, though little accustomed to these minute observations, a very sensible difference between that part of the field which had been manured, and the other. Kliyogg computed this difference to be one third loss in the crop. The manure he made use of, was a small gravel of a bluish hue, and bordering upon marle; the soil on which it was spread being a greasy, reddish sand. Kliyogg discovered veins of this gravel running along the sides of some barren uncultivated hills in the neighbourhood, commonly on the superficies, or a very few feet below it. In loading his carts, he throws aside the larger stones, strewing only the fine part on light lands. This is one of his occupations on winter days, which the generality of husbandmen devote to indolence, or at least to domestic engagements of small advantage. The deep snow that covers the ground during great part of the winter season, greatly facilitates his work by the use of sledges, and considerably lessens the fatigue of the oxen. I saw him last winter in high delight at the appearance of a settled frost, which gave him hopes of a good road for sledges for some weeks. There seems a great analogy between the operation of this gravel and that ascribed to marle, if it is not indeed the production of the marle itself, which is discoverable among the small particles of gravel. Kliyogg apprehends the salutary effects of this species of manure to arise from the heat communicated to the earth; he also attributes to it the virtue of extirpating baneful herbs, and particularly a kind of *pædiculaire* (*rhinanthus christa galli, Linn.*) a plant so destructive to barley, that when it gets the mastery in a field, there is little to be reaped.

By the assistance of this manure, Kliyogg has converted the worst land imaginable into excellent grain fields. He lately bought near an acre of sterile ground for 4l. 14s. 6d. and hopes to make it worth 21l. 17s. 6d. within a few years, a thing by no means improbable, as he has already given specimens of equal improvement, on soils that had been given up from their barrenness or distant situation. Alterations so astonishing prove, in a

forcible manner, how much foundation there is for his assertion, that we ought to attribute it to the laziness and unskilfulness of the peasants, if our country does not produce even a superfluity of grain!

Dressing lands with this manure is not a new discovery; the negligence of the peasants seems the reason why it is not more practised. These allege, by way of justification, that they will not pretend to dispute its efficacy for a few years; but that after a certain term, the ground will be as much, or rather more impoverished than it was originally. We freely, in reply, grant the operation of this manure to be limited to such a period, when it ought to be renewed, or some other to be substituted in its place; but is not this the case with every improvement in husbandry? It is only as the reward of constant and diligent labour, that the earth yields her treasures to man. Kliyogg supports all his arguments on this principle, which has never deceived him. The fortunate success with which heaven has blessed his industry, encourages him, with assiduous application, to invent new operations, rationally deduced from new experiments in agriculture. The effects of gravel led him to this general maxim, *that every species of earth may be instrumental to the improvement of another of opposite qualities.* The discovery, therefore, of a stratum of earth hitherto unknown to him, is as great an acquisition in his eyes, as a purse of gold in those of a miser.

Method of Reclaiming Wet Lands.

Kliyogg has another peculiarity in the culture of his arable land. Disapproving the custom of throwing it into ridges to prevent wetness, which not only wastes much land, but occasions the roots of the grain on the sides of the ridges to be overflowed as they lie in the furrows between; he thus remedied the double injury. He changed these furrows into trenches of the depth of about two feet, which he half-filled with large stones, and then covered with pine branches, spreading the earth taken out of the trenches over the whole. In this manner he regained so much lost land, and obtained from it as good grain as from the rest of the field.* By a process nearly re-

* This is the famous method of draining all sorts of wet soils in England. I do not remember meeting before with any mention of it in the French authors It is very extraordinary that this peasant, enlightened only by nature, should unite in his little farm, so many of the best practices of European husbandry! Y.

sembling this, he has made a very fine hemp field of a piece of ground situated in a sloping bottom, on the side of a great road, which, after heavy rains, was constantly overflowed by torrents coming from the road, and had been given up as unprofitable.

The cultivation, by farmers, of abundant crops of Garden Vegetables for Family Use, good economy.

Our wise cultivator has appropriated a pretty large enclosure to the culture of *vegetables*, such as French beans, pease, cabbages, &c. These suffice for the maintenance of his family during the greater part of summer, a branch of economy that distinguishes him from the peasants of that country, who, excepting the beet, cultivate very little vegetable food, which obliges them to consume a much greater quantity of bread and flour, and diminishes in proportion the only means they have of procuring money, so necessary to pursue their improvements. His children are entrusted with his kitchen garden; an easy task, adapted to their strength, and which trains them gradually to the performance of more toilsome work.

Potatoes more profitable than any other kind of Crop.

I ought not to omit his rules for the culture of *potatoes*, as he is the first man in the village who has made them an essential object of attention; the other peasants being satisfied with having some beds of them in their gardens.* The excellent properties of potatoes and their great utility, have given them, in the opinion of Kliyogg, a very decisive preference over all other fruits of the earth. One acre produces two hundred bushels. The daily consumption in his family is one bushel. He computes that the comparative value of an acre of potatoes to an acre of wheat, is, as ten to six; a very essential difference! We may likewise add, that this root remains in security under ground, free from those dangers to which plants and grains are exposed from the variations of seasons. Neither the nipping frosts in spring, nor snow, nor hail, which so frequently disappoint and destroy the labours of the husbandman, can injure the growth of potatoes. In promoting their culture we find a new resource against national alarms, and a well-grounded hope that

* The culture of potatoes is in a manner recent, and this part of the Rural Socrates was written half a century ago. What appears, therefore, either mistaken or common in the text, must be excused. E.

better rural economy may, by degrees, release us from that dependance on our neighbours, the unavoidable consequence of our present situation. Let the culture of potatoes once become general, the industrious peasant will procure, from a very small piece of ground, a comfortable subsistence for his family; nor will he be liable to disappointment even in the most unfriendly years. He will cultivate, within a trifle, the same quantity of arable land, and will be able to carry to market the profits of his harvest almost entire, whilst before this discovery, he expended a very considerable part in his household. This advantage is so manifest, that the culture of potatoes is already common in many districts of Switzerland, particularly in those whose vicinity to the Alps exposes them most to the inclemency of winter. I apprehend it will not be thought an useless process, if we enter into a circumstantial detail of Kliyogg's husbandry in this essential branch.

When he has selected a proper spot of ground, it is prepared in autumn by ploughing, after first spreading over it some tumbrels of marley gravel, especially if the soil is subject to weeds. Towards the following spring, he lays ten loads of manure on an acre, and ploughs a second time. He then sets the potatoes in the furrows, two or three together, leaving a foot's space betwixt. The very large ones may be cut in pieces. His allowance is ten bushels an acre. Thus planted, the field is covered again with manure, and left in that state fifteen days,* when it is harrowed over. A dry season is judged best for planting, as it is more likely to kill the weeds which are dislodged; for the success of potatoes chiefly depends on the assiduity of the husbandman in cleaning the ground. For this reason, great attention is required when the leaves of the potatoes shoot half a foot above the surface, to have it carefully weeded. When this is done, Kliyogg waters them from his pools. If a fresh crop of noxious plants arises, a second, and often a third weeding is bestowed. In the autumn, about a fortnight after seed-time, the potatoes are drawn out of the ground. He begins to gather in his harvest by cutting the tops close to the ground; if this can be done a month sooner it answers much better, he thinks,

* This operation is probably designed to prevent the starting of weeds. E.

by supplying the cattle with wholesome and well tasted forage.* The ground is then stirred with a pitch-fork to loosen the potatoes, which are gathered in baskets, and carried home in sacks.

ESSAY ON THE EXPRESSING OF OIL FROM SUN-FLOWER SEED, &c.

BY DR. J. MORGAN.

[Transactions of the American Philosophical Society.]

THE grinding of the sun-flower seed and expressing oil from the same, is a manufacture, which, as far as can be yet learned, was first begun among the Moravian brethren at Bethlehem, and may be found useful as a substitute for olive oil in its various uses.

From experiments made at Bethlehem, it is found that a bushel of the sun-flower seed will yield near a gallon of mild oil.

Our correspondent at Lancaster, informs the society, that some persons in the neighbourhood of that place have also expressed a quantity of oil from the seeds of the sun-flower. His account is as follows.

"The person, who has raised the greatest quantity of the sun-flowers with us, informs me, that one hundred plants, set about three feet distant from each other, in the same manner Indian corn is commonly planted, will produce one bushel of seed, without any other trouble than that of putting the seed into the ground, from which he thinks one gallon of oil may be made. As the sun-flower is a plant of great increase, and requires much nourishment, hilling does not seem so good a method as that of setting the seed or plant in a hole, and when the plant is about a yard high, to throw in the mould round the stalk so that the surface of the ground may be even about it. By an estimate made, it appears that one acre of land will yield to the planter between forty and fifty bushels of seed, which will produce as many gallons of oil.

* However wholesome it may be, it is by no means well tasted; and I know from experience, that cattle, while they are supplied with the common sorts of food, will not touch them. Y. Horned cattle devour them in the northern parts of the United States. E.

The process of obtaining the oil from the sun-flower seed, as well as from the seeds of other plants, and from walnuts, filberts, &c. is as follows. The seeds are first rubbed to powder, or ground in a mill. They are then put into a strong bag made of canvass or woollen cloth, and committed to a press between iron plates, by which the oil is squeezed out, and is received or conducted into a proper vessel to collect it. The plates of the press are often heated, either in boiling water or before the fire. Many heat the mash itself in a large iron pot, stirring it about with a stick or piece of wood, to prevent its burning, which, when it happens, greatly injures the oil, and gives it a burnt smell and taste, or disposes it to become rancid in a short time. When the oil is drawn without the assistance of heat, it is known by the name of cold drawn oil, and is more valuable than when heat is used, but it is not obtained in the same quantity. It is milder and may be kept longer without spoiling.

In a cold season of the year a certain degree of heat is absolutely necessary. But if the oil be designed for aliment or medicine, the plates of the press should be heated in boiling water only. When the oil is intended for other uses, the plates may be made hotter, as heat expedites the separation of the oil, and gives a greater produce.

Sometimes the matter, when ground, appears almost like a dry powder. It is then said to be meager, and requires to be exposed to the vapours of boiling water, which is done either by tying it up in a bag or putting it into a sieve, and placing it over the steam. By this impregnation it will yield its oil more readily, and in greater quantity. The oil may easily be freed from any water that may happen to be pressed with it, as a spontaneous separation between them will take place on standing for some time.

It may be observed that all the oils from whatever vegetable substances they are drawn, when obtained by expression with due caution, agree in their general qualities, and are constantly mild, even though they are obtained from very acrid substances. Thus the expressed oil of mustard seed is, when fresh, as mild as that of olives, and the bitter almond or peach kernel, affords an oil by expression as mild as that of sweet almonds; so that sun flower oil may prove equally valuable with the best Florence oil for diet or medicine. For every expressed oil, when pure

and fresh, is void of acrimony, and free from any particular taste or smell.

Besides the mild oil just mentioned, some substances contain another kind of oil, called its essential oil, a part of which may be drawn off with the mild expressed oil, so called, and impart its smell or taste to that oil. It is called essential oil, from its yielding the particular odour of the vegetable or part of the plant from which it was obtained, it is pungent to the taste and soluble in spirits of wine, which the other is not.

The oil of sweet almonds and the oil of olives being pure unctuous expressed oils, not soluble in spirits of wine, but mild to the taste, and void of odour, very soft, emolient and lenitive, are chiefly used in medicine and diet. Perhaps on trial the sun-flower seeds will be found to contain an oil, that will answer the like good purposes with the sallad and medicinal oil now in use. The practicableness of procuring a native oil at a moderate expense, and the importance of using it fresh, together with the probable uses of sun-flower oil for varnishes, for the basis of ointments, and for mixing of paints, as well as other purposes to which oils may be applied, claim our attention to this subject.

INTELLIGENCE.

THE Society's premium of $50 has been adjudged to Mr. ELI COOLEY, of *Deerfield*, "for the best breed of swine, ~~that will afford the greatest weight.~~"

"I fattened," he says, "eight hogs, which weighed as follows, at nineteen months old—

One	577	pounds.
One	492	do.
One	520	do.
One	423	do.
One	492	do.
One	445	do.

The above was the weight in market.

One	405	do.
One	455	do.

The two last were put up for family use.

The above mentioned hogs were from a male brought from Roxbury, Massachusetts, and which is here known by the Stebbins' breed, and a sixth part Russia.

They were a litter of July, 1313, and nothing unusual occurred in the care of them, until the time of making cider; during this time, they ran with the dam in the cider yard, and eat the pomace. the next winter, they were confined and fed mostly on raw potatoes. The succeeding spring gave them some provender, (a mixture of corn and oats,) until the grass and weeds had grown, then fed them on that and weeds, and gave for drink, the wash of the house, with but a very little provender in it. When pumpkins had arrived at maturity, fed them for about fifteen or twenty days on them boiled, then fed them on boiled potatoes, until the first of December, 1814, mixed with some provender. Then fed them with as much provender (half corn and half oats) as they would eat, and corn on the ear, until fifteen or twenty days before they were killed; after which time, I increased the quantity of corn in the provender. From the first of December, 1814,

to the twenty-fourth of February succeeding, I gave them about six quarts of provender each in a day. Almost daily, summer and winter, gave them fresh air in the sty. In cold weather made their swill about milk warm. All of the above hogs were very thick set and small bone, with very small ears and slim tails. I have taken much care in crossing the breed, and in obtaining a due proportion of those breeds I esteemed the best. The eight weighed before starting for market 3861 pounds; and six, in market, 2949 pounds, and were sold for 13⅝ cents per pound. They were killed on the twenty-fourth of February, 1815."

THE Society's premium for the best machine for cutting straw, hay, and corn-stalks for cattle, has been adjudged to Elihu Hotchkiss, of Brattleborough, Vermont. A description of this machine, with an engraving, will be given in No. 1. of our next volume.

Catalogue of Approved Works on Agriculture in its Various Branches.

AGRICULTURA de Crescenzio, 4to. Printed 1478, Florence, or Pietro Crescentio d'Agricoltura, 8vo. Printed 1542, Venice.

"A new orchard and garden; by William Lawson. Edition 1648 or 1660. Printed with Markham's 4to 'Way to Get Wealth,' otherwise entitled "A new orchard, &c. or "The best way for planting, grafting, &c. with the country house wife's garden for herbs of common use; their virtues, &c. Also, Husbandry of Bees, &c.

A Garden of all sorts of Pleasant Flowers, &c. or Paradisi in Sole Paradisus Terrestris. Collected by John Parkinson, apothecary of London; 1629, folio. Printed by H. Lownes and Robert Young—612 pages with 109 wood cuts of flowers and fruits.

An Essay on Timber Trees; by Joseph Hall, 1645.

English Improver Improved, 4to; by Walter Blith. Printed in 1653—third edition.

Evelyn's Silva or a Discourse on Forest Trees, in two books. Fifth edition 1776 with notes by Alexander Hunter, M. D. Printed at York.

Systema Agriculturæ; the Mystery of Husbandry Discovered; By John Worlidge, gent. Fourth edition 1687, folio. London, printed by Thomas Dring. Pages 326.

New Improvements of Planting and Gardening; by Richard Bradley, Fellow of the Royal Society. Sixth edition, pages 608, 8vo. 1731.

A General Treatise of Husbandry and Gendening; by Richard Bradley, in four volumes 8vo. 1726, or the edition of 1766.

The Gentleman and Farmer's Guide in regard to Cattle, with cuts, 1729—8vo.

New Horse-Hoeing Husbandry, or an Essay on the Principles of Tillage and Vegetation; by Jethro Tull, 8vo. Edition, 1762.

An Account of a Threshing Machine, invented at Dalkeith, in Scotland, which in a minute gives 1320 strokes, as many as thirty-three men—1735.

The Husbandry of L. Junius Columella, in twelve books, with his book concerning Trees; translated from the Latin by Gibson, 4to—1744.

A Treatise of Fruit Trees; by Thomas Hill, gardener to Lord R. Manners, &c. Third edition, 1760.

Miscellaneous Tracts relating to Natural History, Husbandry and Physick, to which is added the Calendar of Flora; By Benjamin Stillingfleet. London, third edition, 1775—391 pages, 11 plates of Grasses.

Practical Treatise on cultivating Lucern; by Bartholomew Rocque, 8vo. 1765.

Elliot's Essays on Field Husbandry in New-England, 1764.

Foreign Essays on Agriculture and Arts, containing the Discoveries made in the Several Provinces of France, Germany, Flanders, Sweden, and Switzerland, 8vo—1764.

A Treatise on Hemp; translated from the French of M. Marcandier, 12mo—1764.

The Complete Grazier, or Gentleman and Farmer's Directory, 8vo—1767.

A Tour in Ireland, with General Observations on the Present State of that Kingdom, made in the years 1776, 7 and 8, and brought down to the end of 1779; by Arthur Young. Second edition, 2 vols.—printed 1780.

A Treatise on the Management of Bees; by Thomas Wildman. Second edition, with an appendix, 8vo.—1770.

The American Traveller, or Observations on the present state, culture, and commerce of the British Colonies, 4to.—1770.

Georgical Essays; by A. Hunter, M. D. F. R. S. Six vols 8vo.—1803 and 1804.

American Husbandry; containing an Account of the Soil, Climate, Productions, and Agriculture of the British colonies in North America and the West-Indies, by an American. In two vols. 8vo. London, Bew, 1775.

Observations on the Grafting of Trees; by Thomas Andrew Knight, Esq. in philosophical transactions for 1795.

Report of the Committee of the Board of Agriculture, concerning the Culture and Use of Potatoes. London, Nicol. 1795, 4to.

A Treatise on the Culture of the Apple and Pear, and on the Manufacture of Cider and Perry; by T. A. Knight, Esquire, 1797—12mo.

Agricultural Reports for Northumberland; by J. Bailey and G. Culley; of Cumberland, by the same; of Westmoreland, by A. Pringle; and Suffolk by A. Young, 8vo—1797.

Communications to the Board of Agriculture, on Subjects relative to the Husbandry and Internal Improvement of the Country, 1 vol. 4to 1797.

Translation of the Linnæan Society, vol. 4th; Description of the Blight of Wheat, Uredo Frumenti, by A B. Lambert, Esq. Further Observations on the Wheat Insect, by M. Marsham. History of Tipula Tritici and Ichneumon Tipulæ, with some Observations upon other Insects that attend the Wheat. in a letter to Thomas Marsham, Esq. By the Rev. William Kirby, 1798.

Agricultural Reports (in 8vo.) for Middlesex, by John Middleton, Esq.; Nottinghamshire, by Robert Lowe. Esq.; Somersetshire, by Robert Billingsley, Esq.; Argyllshire, by John Smith, D. D; Clydesdale, by John Naismith; Roxburgh and Selkirk, by Robert Douglas. D. D.—1798.

Fifth volume of the Linnæn Transactions, 1800.

A Short Account of the Disease in Corn, called the Blight, the Mildew, and the Rust; by Sir Joseph Banks. London, 4to—14 pages and two plates. 1805.

A Complete System of Practical Agriculture; by R. W. Dickson, M. D. of Hendon, Middlesex. Two vols. 4to with plates, 1805.

Young's Works, 8vo. 13 vols.
Stone's Review, 8vo. 1 vol.
Marshall's Southern Counties, 8vo. 2 vols.
Marshall's Minutes, 8vo. 2 vols.
Anderson's Essays, 8vo. 3 vols.
Anderson's Recreations, 8vo. 4 vols.
Bath Society's papers, 8vo. 9 vols.
Agricultural papers. Published by the Board of Agriculture in England, 4to, 5 vols.
Elkinton on draining wet lands, 4to. 1 vol.
Mr. Mahon's Gardening, 8vo. 1 vol.
Farmer's Dictionary, 8vo. 1 vol.
Farmer's Callendar, 8vo. 1 vol.
Forsyth on Fruit Trees, 8vo. 1 vol.
Agricultural Tracts, 8vo. 1 vol.
Banister's Husbandry, 8vo. 1 vol.
Flora Rustica, 8vo. 1 vol.
Memoirs of the Philadelphia Agricultural Society, 8vo. 2 vols.
Michaux's Arbres Forestiers, 8vo. 1 vol.
Hawes on Agriculture, 12mo. 1 vol.
Complete Farmer, folio, 2 vols.
Farmer's Magazine, 8vo. 6 vols.
Recreations in Agriculture, Natural History, &c. 8vo. 1 vol.
New York Society's Publications, 4to. 4 parts.
Michaux's Flora Boreali Americana, 8vo. 2 vols.
Lasteyria on Merino Sheep, 8vo. 3 vols.
Daubenton's advice to Shepherds, 8vo. 1 vol.

PREMIUMS

Offered by the Trustees of the Massachusetts Society for Promoting Agriculture.

1. To the person who shall have raised within two years from the first day of June, 1814, the greatest quantity of woad within this Commonwealth, not less however than three hundred pounds, and shall produce to this Board specimens of the same, provided the quality thereof be good, a premium of *one hundred dollars*.

2. To the person who shall within three years from the first day of June, 1814, produce a specimen of madder of good quality of his own growth, and who shall have actually raised the greatest quantity thereof, in this Commonwealth, being not less than 1000 pounds, a premium of *one hundred dollars*.

3. To the person who shall invent the most approved machine for thrashing or separating grain, (regard being had to its fitness for a medium farm,) a premium of *one hundred dollars* ; to be claimed on or before the first day of June, 1816.

It is requested that the communications, for which the foregoing premiums are offered, be accompanied with proper certificates from the selectmen, magistrates, or clergymen of the vicinity, or other vouchers, to the satisfaction of the Trustees ; that they be delivered without names, or any intimation to whom they belong ; and that they be severally marked in such manner as each claimant shall think fit ; the claimant sending also a paper, sealed up, having on the outside a corresponding mark, and on the inside his name and address.

RICHARD SULLIVAN, *Recording Secretary.*